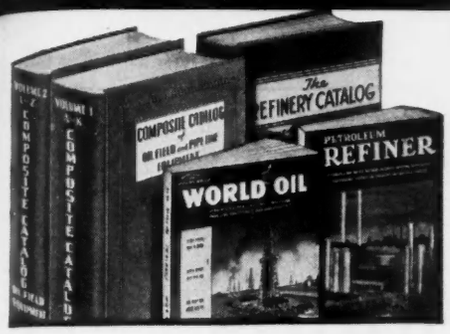

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for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

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WORLD OIL

Established 1916 as THE OIL WEEKLY

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AN IMPORTANT ANNOUNCEMENT . . .

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SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Publisher's Page

GATHERING OPTIMISM was being felt by the domestic oil industry as March came to a close. Fear of a general reduction in the price of crude seemed, at least temporarily, to have been lessened if not completely dissipated.

The gasoline stock situation was improving. Heating oil weather in the heavy consuming areas was taking care of a considerable part of the surplus of this product accumulated last summer and fall, and oil men generally were beginning to feel that the over-all picture was brighter.

Confidence improved that predicted increases in oil consumption would occur. Opinions that some of the reductions in crude allowables in important oil-producing states would be lifted in May were heard from concerns who expressed the fear that they might face a tight crude situation generally and who seemed positive that the sweet oil supply would certainly have to be increased. A scarcity of such oils was even mentioned.

NO JOY, of course, was being felt by most oil producers over the heavy cuts in allowables. Some producers have pointed out that the strength of their financial position has suffered because of these reductions of their crude production. "Exploration campaigns cannot but suffer if the ability to wildcat is cut down," we were told. And of course that is true.

If demand in 1949 runs at the rate predicted by a number of agencies, governmental and private, we agree that there will be increases in allowable probably in the late spring and early summer, and we see no reason at this time to think that consumption this year will not run around 7 percent more than in 1948.

GASOLINE STOCKS at the close of March were dropping. Some companies were re-running heating oils against prospects of increased gasoline demand.

"Where are all of these gasoline stocks?" we were asked. "Our company doesn't have them. Who has them?" A favorable sign.

While there is some disagreement with the writer's opinion, expressed early in the year, that imports would be less this year than in 1948, we still hold to that belief. We think policy will determine some reduction and if policy doesn't, the combined front of the independents and some state governments which have been hard hit by oil tax losses, constitute a force not to be disregarded.

LESS OPTIMISTIC opinion still felt that the situation had improved, and that April allowables, in Texas, would mean reduction in stocks. "Not quite out of the woods, yet" was the feeling of those who were not so optimistic. Careful consideration of probable demand in planning refinery runs was held to be especially desirable.

All of which brings us back to what caused the wave of pessimism which swept the industry the last two weeks in December and the first few weeks of 1949:

At that time we said in WORLD OIL that a combination of three things, all of which were of an emergency or temporary, rather than a permanent, nature were responsible for the pessimism. One was the mildest winter on the Atlantic seaboard in many years. Another was the effect of two strikes, one on the Atlantic and the other on the Pacific coast which tied up shipping. A third, we said, was the effect of the campaign waged by the oil industry last summer in urging prospective consumers of heating oils to be cautious in buying oil burners. (In this the industry was simply playing it safe to make sure that it could supply the demand already existing for burning oils.)

AS WE REVIEW those months from the advantage of a better perspective, it seems to us that some other factors entered into the picture. For one thing crude production and refinery runs had been moved up too high. (Many felt that m.e.r.'s were being disregarded over wide areas). The other factor was the general industrial pessimism which accompanied the very real fear that exorbitant taxes might be levied on industry in general, including the oil industry. Certainly the period just prior to the close of the year was not one to arouse enthusiasm on the part of any business.

If the writer can be allowed to express a hope, without being sued by state or federal government for what he hopes, it is that nobody monkeys with the price of crude!

Ray L. Dudley

CLEAN UP THE "WORKING SURFACE" OF YOUR CASING

Read these facts about the Baker Rotary Casing Scraper

Have you ever tried to run testing tools or a swab, and had the rubber packing unit or the rubber cups so badly cut, torn and mutilated that the run was a failure? The chances are that trouble was caused by burrs from gunshot holes or by the sheath of hardened cement or mud which remains on the inside walls of casing, even after a bit of maximum possible gauge has been used to drill out after a cement job.

Until quite recently there was no fast, simple method of overcoming these difficulties. Now, however, it is truly a waste of time, temper and money to leave any obstructions adhering to or protruding from the "working surface" of your casing. The Baker Rotary Casing Scraper quickly, positively and economically removes *all* obstructions from the inside walls of casing, leaving the surface clean and smooth—ready for *immediate* testing and completion—and in good condition for any remedial or work-over operations *one year or ten years in the future.*

STRONG, SIMPLE CONSTRUCTION

The Baker Rotary Casing Scraper consists of a strong body in which three long, reamer-type, hard-faced blades are vertically mounted. These three blades form an expansible reamer due to the fact that they are pressed outward against the inside walls of the casing by a number of coil springs. This self-equalizing feature insures constant, uniform contact with the walls of the casing, and is one of the secrets of the clean, smooth scraping action. Hard facing is applied in a flat, rectangular recess to form the long cutting edge of each blade, and a worthwhile amount of scraping can be done before the blades are dulled.

Ample circulating areas permit free disposal of cuttings; the streamlined exterior of the body insures ease in running-in; and if by accident the Casing Scraper is run out of the lower end of the casing, there is no difficulty in bringing it back inside for removal from the well.

FACTS ABOUT ITS USE

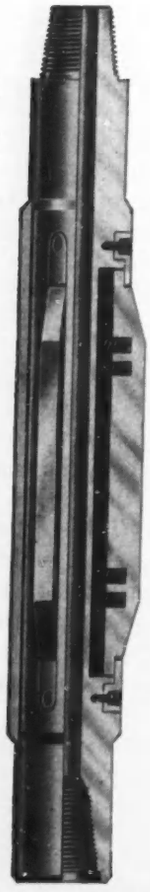
The ideal time to use a Baker Rotary Casing Scraper is while the rotary rig is still up and the crew is on hand. Install the Casing Scraper just above the bit when going in to drill out the cement shoe. Even when a bit of the maximum possible gauge is used for drilling-out, a thin, hard sheath (or skin) of cement will still remain adhering to the inside walls of the casing. The Baker Rotary Casing Scraper removes not only this hardened sheath of cement, but also scrapes away all mill scale, and smooths out rough areas. The inside of the casing is left clean and smooth, ready for trouble-free, down-hole work immediately thereafter, or at any future time.

If the well is gun perforated, then a second run of the Baker Rotary Casing Scraper will remove any burrs left around the gun-shot holes. The slight additional cost of this second run is negligible when you consider what the clean, smooth casing will mean when any future down-hole work is done.

If at a later time, after the rotary has been removed, obstructions on the inside walls of the casing interfere with operations, the Baker Rotary Casing Scraper still can be employed successfully. By running the Casing Scraper on tubing, and rotating manually with tongs, limited areas may be scraped; while several hundred feet of casing have been scraped by rotation of the tubing with an endless spinning rope, or by means of air tongs.

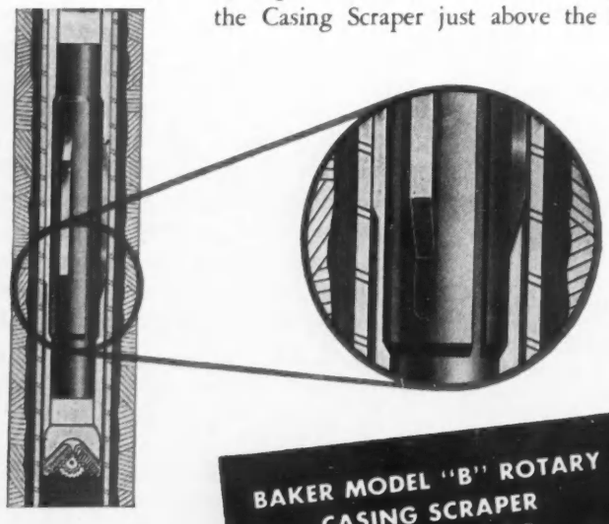
IT'S EASY TO HAVE THE "WORKING SURFACE" OF YOUR CASING IN PERFECT CONDITION

Baker Rotary Casing Scrapers are furnished on a low-cost rental basis in domestic fields, and *your* crews can run them easily and successfully to scrape the "working surface" of the casing before running casing, tubing, liners, swabs, testing tools, cement retainers, packers or other similar tools. It pays off in savings of time, temper and money.—Why not call the nearest Baker service engineer and start enjoying these benefits in *your* wells?



(Left) With only four springs back of each blade, burrs from gunshot holes are readily removed.

(Below) Notice the "trouble-making" sheath of cement left behind the bit, and how the blades remove it.



BAKER MODEL "B" ROTARY CASING SCRAPER
Product No. 620-B

BAKER OIL TOOLS, INC. LOS ANGELES • HOUSTON • NEW YORK

The Changing Panorama

World Drilling Depth Record Is Significant

IT IS noteworthy that The Superior Oil Company has been able to establish a new world's drilling depth record while using a nine-year-old conventional rig. The record is 18,739 feet, reached by the company's Limoneira 1, a wildcat in the Montalvo area of Ventura County, California.

Purchased in March, 1940, the steam-powered rig previously had been used in drilling wells whose depths seldom exceeded 10,000 to 12,000 feet. When ordered the rig was equipped with a drawworks which at the time was out of the ordinary in that it was unusually large and was grooved for 1¼-inch line. However, it was these very features which contributed in a major way to the successful drilling of the record-breaking hole. It was possible to handle the extremely heavy loads because of the use of ten of the larger diameter lines, and only a big drum could have accommodated the additional line that had to be spooled.

The performance of this rig goes far toward substantiating the belief of many that it is wise to buy drilling equipment with capacities in excess of those required by immediate plans.

Depth of 20,000 Feet Is Likely in Near Future

PENETRATION OF the earth to 18,739 feet by a nine-year old rig presages that the 20,000-foot mark is not far in the future. Drilling depths have advanced 6000 feet in the last 14 years, the first 12,000-foot well in history having been drilled in 1935. Today that depth has been exceeded in nine different states, and is common in several of them.

The probability of reaching 20,000 feet in the near future is greatly enhanced by the great advancement in rig design since the end of the war. Development of hydraulic drives have made possible multi-engine power drives necessary to compound sufficient horsepower to handle extreme loads of drill pipe and casing at these great depths. Drawworks have been revamped to meet the more than 2000 horsepower rating requirements for this depth drilling. The most critical part of the rig in 20,000-foot drilling and one that has caused much concern to equipment suppliers as well as drilling equipment engineers is the hoisting system. To overcome physical limits of present improved steels, wire rope sizes for deep drilling have been increased to 1½ inches in diameter. Hoisting equipment, such as the traveling block, crown block and drawworks drum, has been redesigned to accommodate the bigger wire line.

SAE 4340 steel has temporarily answered the problem of 20,000-foot drill pipe and casing strings. However, there are operational problems yet to be solved. Extreme temperatures and pressures at this depth impose serious obstacles in the mud program, electrical logging, coring, and other operations attendant on the drilling of 20,000-foot wells. It is sufficient to point out here that the development of equipment to overcome these problems are paralelling the development of surface equipment to handle the heavy loads and high pressures.

Many Changes Made in Engineering Thinking

RADICAL CHANGES have taken place in the industry's engineering thinking. Twenty years ago engineers were concerned largely with mechanical problems. Today much of the industry's engineering work is devoted to reservoir studies and how to produce oil and gas most efficiently and economically.

Twenty years ago sucker rod troubles, crankshaft breakage, rig front trouble, drill pipe failures, standardization of equipment, etc., were matters of top consideration. While the industry still is battling such problems, they are not now as important as problems pertaining to reservoir.

In order to continue to drill terrifically expensive deep wells, it is necessary that the most modern and advanced methods of oil and gas recovery be used. This means checking each reservoir to determine whether it is a gas-drive or a water-drive field, studies on optimum producing rates, whether the reservoir will respond to cycling, repressuring, pressure maintenance, water drives, and a host of other questions.

Correct answers to reservoir problems will determine whether the field should be developed, and how it should be drilled and produced. Ultimate recoveries have been increased sharply as a result of such engineering work. Recent years have witnessed a great deal of progress on reservoir engineering, and coming years will see much additional advancement take place.

Refiners Face Yield Adjustment Problem

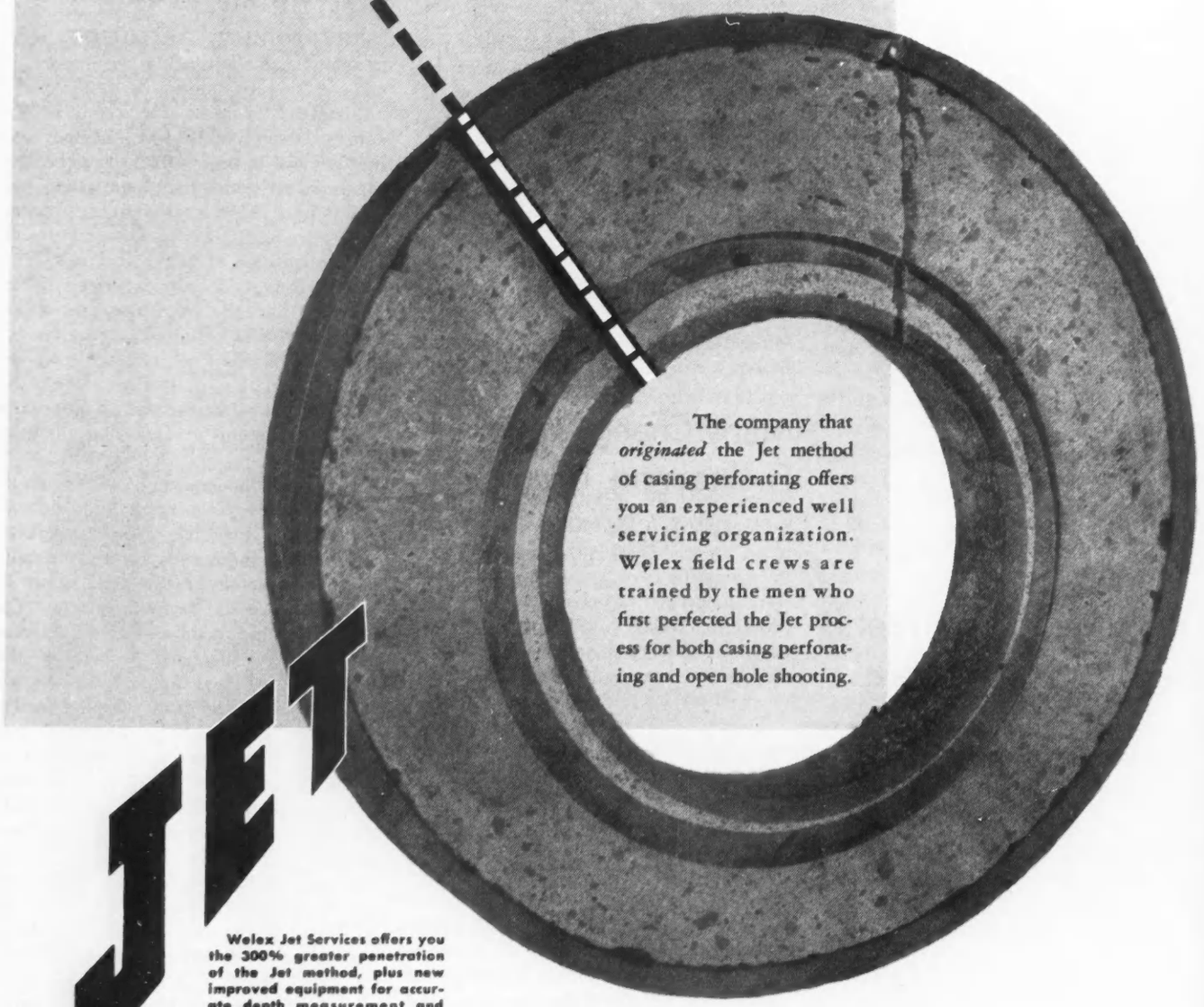
PETROLEUM PRODUCT relationships are undergoing an important change, thereby posing a major yield adjustment problem for refiners. To supply requirements for gasoline and lighter distillates, refinery operations must be maintained at high rates, but maintaining high-level refinery operations also results in the manufacture of large quantities of heavy fuel oils. The latter product is not experiencing as great an increase in demand as gasoline and distillate fuel oil; consequently, excessive amounts of residual fuel oil are accumulating in storage. Stocks of residual fuel oil at the end of February were 63 percent greater than a year ago.

In 1948, the consumption of gasoline increased 7.2 percent and the use of distillate fuel oil rose 9.6 percent despite the industry's successful campaign to discourage the installation of additional fuel oil heating systems. On the other hand, residual fuel oil demand decreased 3.1 percent. A part of the decline in residual fuel oil can be attributed to the lengthy shipping strike, but other factors of a permanent nature also played an important role.

Dieselization of railroad motive power is an important factor. Virtually all new locomotives being put into service are diesels. This is increasing the use of lighter fuel oils, but each oil-burning steam locomotive taken out of service cuts out a relatively large consumption of heavy fuel oil. A rule of thumb average is that one barrel of diesel oil for railroads displaces approximately four barrels of heavy fuel oil.

The growing imbalance of refined product relationships is expected to continue and increase in significance, and thus the problem posed for refiners becomes apparent. They must increase their yields of gasoline and lighter fuels and decrease their output of heavy fuel oils.

How to Perforate Casing *for* DEEPER PENETRATION *and* INCREASED OIL FLOW



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Monthly News Analysis

LOWER OUTPUT TO HELP STOCKS . . . GOVERNMENT PUSHES PLANS FOR SYNTHETICS
IMPORTS FIGHT INTENSIFIED . . . EMPHASIS PLACED ON REEFS AS OIL SOURCES

Lower U. S. April Crude Output Will Help Stocks

April will see a further substantial cut in U. S. crude production, marking the fourth consecutive month in which producing rates have been reduced. This new slash will reduce output to the lowest level in two years. The nation's crude oil production in April, it is indicated, will be but slightly over 4,900,000 barrels daily, the first time since April, 1947, that output has fallen below the 5 million barrels per day level.

The prospective April production rate will constitute a very sharp cutback since December, 1948, when U. S. output was at an all-time peak of 5,680,000 barrels daily. A year ago, April, 1948, the U. S. produced an average of 5,483,600 barrels daily.

Lower production should have a favorable effect on the industry's economic position. Substantial reduction in refined product stocks should occur in April. Particularly should inventories of gasoline be drawn upon, as heavier consumption of this product usually commences in April and continues rising until fall. Likelihood of a cut in crude prices also is materially dimmed by the April, reduction in production.

It is probable that April's production will mark the low point of 1949. The chances are good that production allowables will begin climbing in May, and continue rising until the end of the year.

Texas Crude Production Gets Another Big Slash

Major factor in reducing the nation's April crude output will be smaller production from the State of Texas. A fourth consecutive monthly reduction in producing rates is scheduled to bring Texas' crude production in April below 2 million barrels daily for the first time since December, 1945.

The Texas Railroad Commission has set April's crude oil allowable at 1,994,360 barrels daily, a reduction of 234,211 barrels from the allowables of 2,228,571 barrels which existed on March 12. This means that Texas' crude production in April will average around 1,900,000 barrels daily, as actual production is always somewhat under the commission's allowable. Such a producing rate will be about 600,000 barrels below the peak of 2,536,000 barrels produced daily in December, 1948, and will also be approximately 500,000 barrels per day below the production of 5,483,000 barrels produced a year ago in April, 1948.

Government Still Wants Big Synthetic Industry

Despite improving supplies of petroleum, the government has not abandoned plans for building a huge synthetic oil industry.

Speaking before the District of Columbia Section of the American Society of Civil Engineers March 8, Undersecretary of Interior Chapman said: "What we need are commercial-size plants with a substantial daily production of synthetic petroleum to help keep our industrial machine working at full capacity and to provide for oil in the event of war. It is estimated that in another war, we would need at least 2 million barrels per day over and beyond present production. We think that we should have synthetic liquid fuel plants with such capacity. Construction of synthetic fuel plants must be begun in the near future; we cannot wait until an emergency is on us before taking action."

Meanwhile, full support of the White House, in effect, was placed behind the synthetic liquid fuels program. John R. Steelman, assistant to the President and acting chairman of the National Security Resources Board, on March 10 told the House and Senate Interstate and Foreign Commerce committees:

"I am in favor of legislation to accomplish the purposes of this (Wolverton) bill. . . . Construction and operation of synthetic liquid fuel plants will provide us with production data necessary to the expansion of a synthetic liquid fuels program."

Congressional support for the program also came during the month, when the Democratic majority of the Congressional Joint Committee on the economic report (O'Mahoney, chairman) declared the federal government "should foster the early development of a synthetic liquid fuels industry."

Despite the foregoing assertions, it is considered unlikely that Congress will pass any measure providing for major construction of commercial synthetic plants. Due to the present ample supply of oil, government planners probably will find it necessary to reevaluate the entire project. The most likely result will be a switching of the program to provide for government experimentation and research plants rather than full-scale commercial plants.

Record Volume of New Oil Is Discovered Last Year

At the same time that government officials and representatives were advocating the need for a huge synthetic oil construction program, the petroleum industry reported that during 1948 it had succeeded in finding the largest volume of new petroleum ever discovered in a single year.

Issuing their joint annual report on reserves, the American Petroleum Institute and the American Gas Association revealed that almost 4 billion barrels of new crude oil was proved to exist in the U. S. during 1948, an amount so great it exceeded record-breaking production by over 1¾ billion barrels. Consequently, the nation now has more proved unproduced oil than ever before in history. Reserves of natural gas and liquid gas also increased to new peaks. (See story page 52).

Political forecasters aren't the only ones who turn in bad guesses. When it comes to being wrong, probably no group of experts has missed the mark more consistently than the forecasters who have predicted America's finish as an oil producing nation.

How badly the "experts" have fared in their predictions at various intervals over the 90-year span since the drilling of the first well at Titusville, Penn., is demonstrated in an article titled "Count on Oil for The Years Ahead" in the current issue of *Our Sun*, a Sun Oil Company publication.

Against the fresh evidence of the

vitality of the American oil resources, *Our Sun* lists the testimony of some of the "Cassandras who croaked dismal warnings that the end of oil supplies was imminent." The article notes that with most cries of "shortage" came an accompanying call for the development of synthetic sources of petroleum.

Although the singers are new on the stage, their refrain is almost as old as the 90-year oil industry itself, *Our Sun* comments.

Fight Against Imports Is Greatly Intensified

With U. S. crude producing rates curtailed further during March, and due to be reduced further in April, independent producers intensified their attacks on large imports of foreign oil, carrying their fight forward on many fronts. Various independents testified before the House and Senate Foreign Affairs committees, and also before the Senate Finance Committee.

They asserted unnecessary imports would damage the domestic industry, causing it to wither away. This condition, they continued, would leave the nation helpless in case of a war since any enemy could cut off movement of foreign oil to this country at any time, and that if the domestic industry was destroyed its talent, brains and ambition would be lost forever.

A vigorous competitive domestic industry, the independents declared, was the greatest possible assurance that sufficient oil would be found and developed to provide enough supplies to protect the nation's security. It was suggested that U. S. imports be limited to the oil export volume of the previous year, and that some rule similar to the Connally Hot Oil Law should be applied to oil imports.

Crude Import Rates Begin Sharp Decline from Peak

A sharp reduction in U. S. crude importation rates appears to have begun, preliminary estimates indicating crude oil imports during February will average around 415,000 barrels daily in contrast with a peak of 473,455 barrels in January and 453,609 in December, 1948. This is in line with assurances from some of the officials of major importing companies.

The February figure represents an estimate, official government figures not yet being available. However, it is expected to be fairly accurate, being based on U. S. refinery runs of foreign crude and changes in U. S. stocks of foreign crude oil.

Further reduction in crude import rates is in prospect. Middle East crude oil imports into the U. S. will fall off sharply for the rest of 1949, according to Eugene Holman, president of Standard Oil Company (N. J.). Holman declared that his company would reduce Middle East imports by 50,000 barrels daily during the first quarter of 1949 from a peak of 90,000 barrels the preceding quarter, and that so far as Jersey Standard is concerned, "all imports of Middle East oil probably will be eliminated completely in the reasonably near future."

Larger Middle East crude imports were responsible for the increase in crude imports during January, due to heavier tanker loadings of late 1948 just reaching the U. S. East Coast. Crude imports from the Middle East totaled 156,766 barrels daily, about one-third of the total imports in the nation. Middle East crude imports in January were 17.4 percent greater than in December, whereas total crude imports from all countries rose but 4.4 percent over December.

Producing Rates of Texas Oil Fields to Be Revised

Many Texas oil fields face the prospect of having their producing rates adjusted, some upward and some downward.

During the oil shortage, the Railroad Commission of Texas was most lenient, setting producing rates at perhaps higher levels than best for conservation. Now that oil is available in such adequate volume as to require the return to more stringent proration, the producing ability of Texas oil fields is to be reexamined.

The commission has ordered all operators to present complete reservoir engineering data on each oil field. Operators are to tell how much gas is being flared daily, the weighted average gas-oil ratio, reservoir pressure, and rate of oil and water production. Hearings by districts will begin April 19 and conclude May 31.

Undoubtedly, this will result in rather widespread revision of field producing rates. Although a few fields may receive higher production quotas, maximum efficient producing rates probably will be reduced in the vast majority of fields. This means those fields which can produce larger volumes without damaging their reservoirs will be granted higher production quotas, to make up for the loss which will occur in other fields.

States Would Be Losers By Enacting Process Tax

If enacted, the one cent per gallon processing tax on gasoline and other fuels proposed by measures now before the legislatures of Texas and Oklahoma are apt to retard seriously the industrial position of these states.

The market for petroleum products is highly competitive, and refiners operating in states imposing such taxes would be at a severe disadvantage. This might cause a movement of the refining industry into other states. Refining plants do not have to be located near producing localities. It is economically sound and feasible for them to be near marketing centers. The refining industry is one of the largest manufacturing enterprises in each of these states, and its loss would be a very hard blow to their industrial position.

Those refiners which might elect to continue operating plants at their present sites, would be forced, in order to compete, to pass the tax back to producers in the form of lower crude prices. The tax would mean about 19 cents per barrel of crude. Such a decrease in crude oil revenue, in a great many instances, would be the difference between operating at a profit or a loss. Under these conditions, producers might reduce their activities in these states and make a greater effort to find production in states not imposing this tax.

In the long run, through either reduced refining or producing operations, the states may lose more taxes than they would gain.

Pennsylvania Grade Crude Gets Fourth Price Cut

Pennsylvania grade crude oil producers now are receiving 25 percent less for their production than early last December. Another reduction of 25 to 32 cents in Pennsylvania grade crude oil prices occurred March 11, constituting the fourth price cut in the past three months.

The new posted prices are: Allegany-Bradford $3.75 per barrel; southwest Pennsylvania $3.29; Eureka $3.23; and Buckeye $3.23. These prices range from $1.25 to $1.56 a barrel lower than prices in existence in early December.

George J. Hanks, president of South Penn Oil Company, declared that production continued to be considerably greater than refiners could absorb and that output should be reduced further to balance supply and demand.

Emphasis Placed on Reefs As Potential Oil Sources

During the next several years, exploration for oil in the United States and Canada likely will lay heavy emphasis on the finding, detailing, and development of oil-bearing reefs. Geophysicists will work with geologists, making much use of the seismograph and also employing the gravity meter in locating reefs.

Interest in reefs has been greatly

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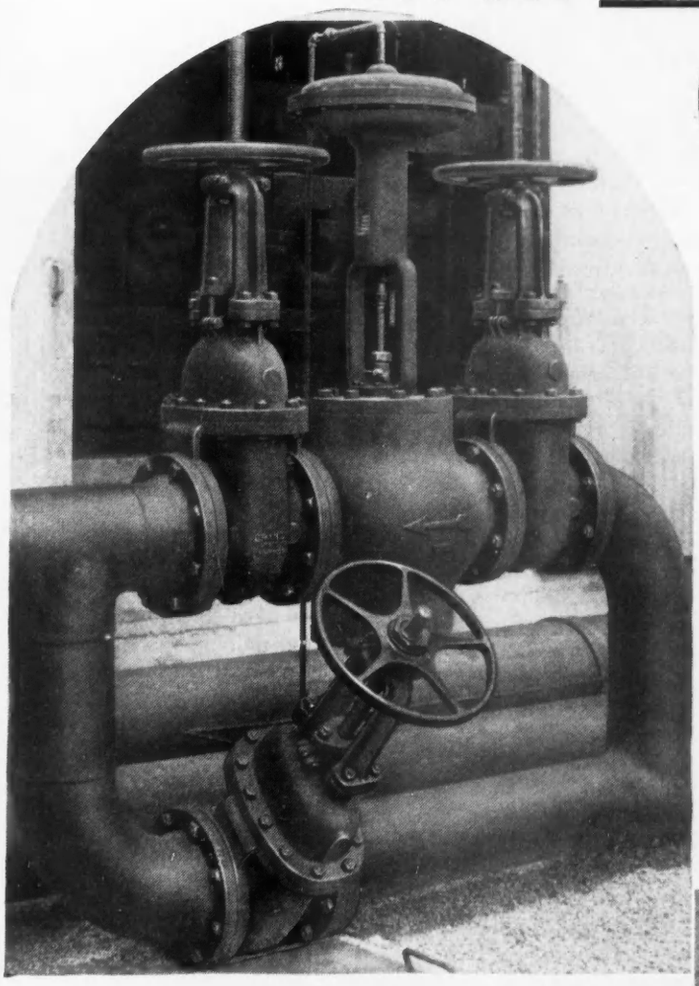

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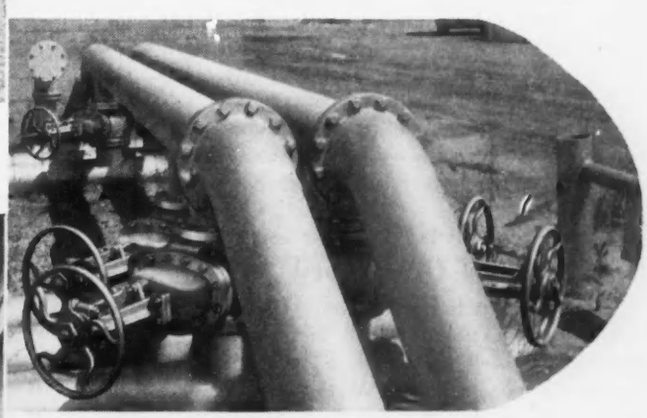

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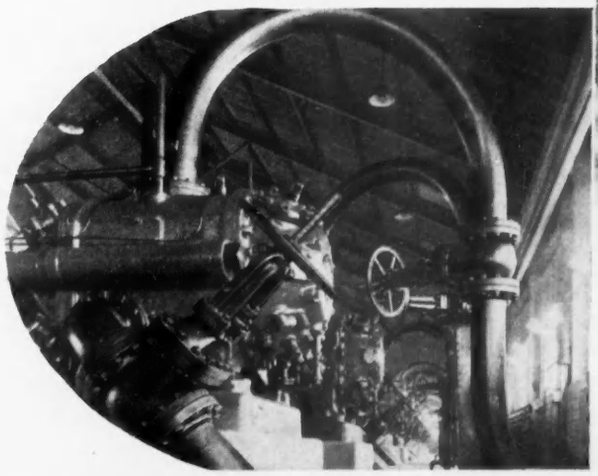

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stimulated by prolific production from reefs in the Leduc and Red Water fields of Canada and the indications that more such fields will be found in that region. In the U. S. the importance of reefs has been demonstrated by good fields yielding oil from reefs in West Texas and North Texas. The eastern part of the Permian Basin has given indication that it may yield important quantities of oil from limestone reefs. In the Middle East, limestone reefs and rocks associated with them are expected to be important sources of oil.

These ancient reefs, some of which are oil reservoirs, are similar to modern coral reefs. They are composed of the hard remains of organisms that lived near the surface of waters. Reefs tended to develop as mounds or ridges. Some of them in which oil will be found will be associated with anticlines and other structures. The Todd field of West Texas, for example, yields oil from a Crinoidal limestone reef growth on the flank of a folded and faulted structure. The discovery well was drilled on the basis of subsurface geology.

Various methods of detailing limestone reefs have been employed by geophysicists, and it is to be expected that success in locating reefs will vary, depending on the nature of adjacent formations and other conditions.

A symposium on reefs was included on the program at the annual meeting of the American Association of Petroleum Geologists at St. Louis March 16, and wide interest in those papers reflected expectations that much exploration effort henceforth will be directed toward locating and testing reefs.

Geophysical Activity in 1948 Highest On Record

Geophysical activity reached record-breaking proportions in 1948, in foreign countries as well as the U. S., according to a paper presented at the annual convention of the Society of Exploration Geophysicists at St. Louis March 15 by Dr. E. A. Eckhardt, vice president of Gulf Research and Development Company. Seismic operations in the U. S. were 17.4 percent above 1947, and foreign seismic work also showed substantial increase.

In 1948 the U. S. accounted for 79.6 percent of seismic operations, with 520 seismograph parties, while 125 gravity meter parties operated in the U. S. in 1948.

Expenditures for geophysical operations in the U. S. reached $125 million in 1948.

Canada accounted for 5.8 percent of world seismic work in 1948 and ranked second to the U. S.

Profits Are Not Cash

By WARREN L. BAKER
Editor

Few business terms are more widely misunderstood by the general public than that of profits. There seems to be almost general confusion as to what comprises the profits reported on business earning statements. All too many think profits represent a sum of money —actual cash—left over after paying all expenses. This is an erroneous conception. A company's reported net income is not the same as the cash account or balance.

Profit is only a bookkeeping term. Under accepted accounting methods, not all the money companies pay out is deducted from total income to arrive at the profit figure. Companies frequently pay out more money, even when dividends are excluded, than they take in during a year and still their books will report a substantial profit. This is due to the fact that money expended for new facilities are not charged against current income. Even though this money is paid out, it still is included in the profit or net income figure on earning statements.

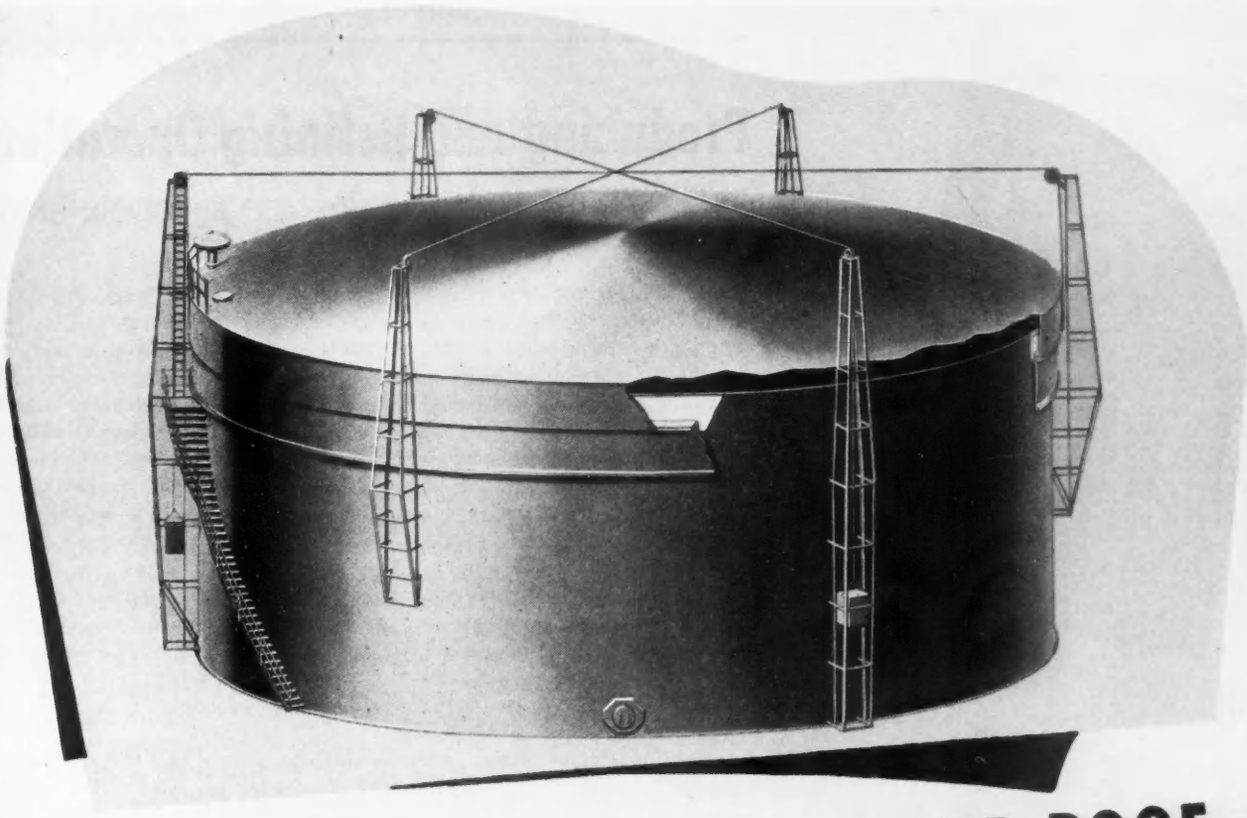
The belief that corporate profits reflect cash sums is rarely true in ordinary times, and is entirely false in times of inflation and whenever business is confronted with more than normal expansion of its facilities to satisfy increased demand for products. Both of these conditions have existed during recent years. Therefore, the apparently large net profits being reported must be analyzed in the light of conditions existing today.

Bookkeeping methods provide funds for purchasing of new facilities through charges made for depreciation, depletion and amortization. However, these charges are based on original equipment and property costs, and consequently the amounts provided by these sources are inadequate to replace these assets whenever current costs exceed those which existed in earlier years.

Never before in history have oil companies . . . and also many other businesses . . . been confronted with the necessity of spending such huge sums for expanded facilities as in recent years. And never before have costs risen so sharply as in late years. Consequently, it has been necessary for business firms to spend very large sums to buy new facilities required to meet increased demand for their products. In some instances, companies have been forced to spend more than their reported net profits and almost without exception all companies have had to spend a very large part of their so-called earnings.

A few typical examples serve to illustrate this point. Union Oil Company's net profits for 1948 are reported at $31 million, of which $16½ million was spent for plant replacement and expansion and $11 1/3 million was distributed as dividends. During the past three years (1946-48), Standard Oil Company (Indiana) had net earnings of $302 million. But during this same period, Standard of Indiana spent $631 million for new facilities, or 2.1 times its net profits. Consequently, in addition to using $205 million or 68 percent of its net profits for purchasing new property and equipment, this company has spent $244 million of borrowed capital, $143 million from charges for depreciation and depletion, and $39 million from other sources. Shell Union Oil Company's net income for 1948 was $111 million, but investments in new facilities totaled $122 million of which only about $60 million was provided for by depletion, depreciation and amortization charges.

Profits are the way funds are accumulated to provide needed new capital investment, which results in jobs and purchaseable commodities for the people. Only as long as profits are permitted to perform these functions will America's business economy and standard of living remain dynamic and strong. A proper understanding of the subject of profits is of major importance, and the first step is a general realization that profits do not represent cash "in the till."



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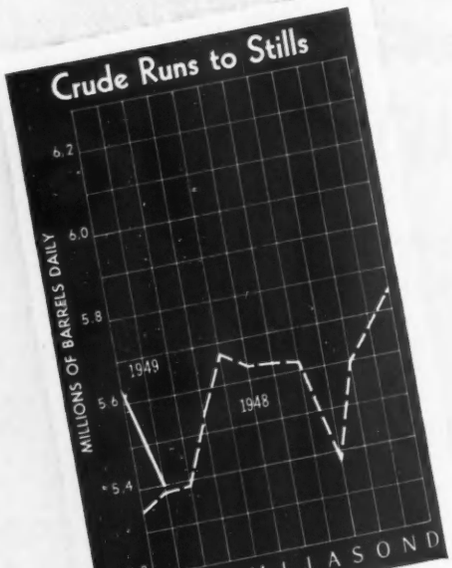
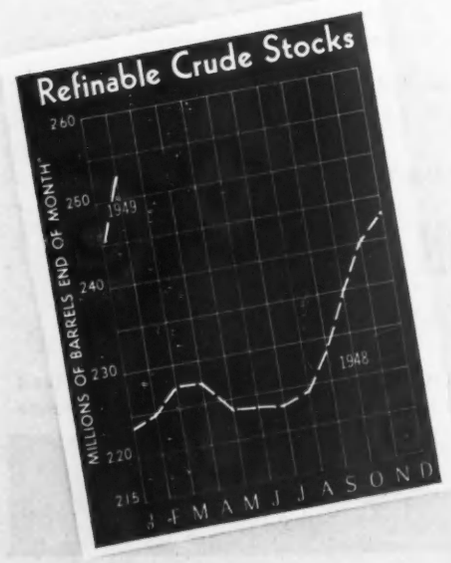
Producing and Refining Operations

By CECIL SMITH,





THE industry's producing and refining rates were cut back sharply during February, but statistics for the month indicate that further reductions are advisable as stocks of crude and products are at very high levels. Despite the easing of refinery operations, gasoline stocks continued to make large gains and ended the month at their highest point in history.

For the first month since last November, daily crude runs to stills were less than daily domestic crude production. Actually, they were nearly in balance for the difference was only 2000 barrels per day. Daily runs averaged 5,490,000 barrels during February, which was a drop of 233,000 barrels from January's average, but only 10,000 a day more than those of February, 1948.

Because of the cutback in crude runs gasoline production was reduced 99,000 barrels per day, yet stocks of finished and unfinished gasoline continued to mount, gaining 8,767,000 barrels to total 124,365,000 barrels. That was the highest point gasoline stocks had ever reached, but even so they did not stop there, for subsequent reports indicate that by mid-March they had advanced to 127 million.

Gasoline stocks at the end of February were 27,828,000 barrels or 12 percent greater than they had been a year earlier, while this year's demand for this product is expected to be only 8 percent greater than in 1948. Some areas are now experiencing gasoline price wars and with

Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1946:									
January	4,625	4,520	223,442	,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	815	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	76,780	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,789	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	230,974	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	228,523	2,383	85,849	869	54,707	1,245	51,334
September	5,251	5,236	225,258	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	226,666	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	225,462	2,332	87,551	942	61,334	1,245	52,455
December	5,337	5,350	224,929	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	223,430	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	224,880	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	227,408	2,252	111,949	1,050	32,124	1,307	41,945
April	5,484	5,540	227,278	2,396	109,289	978	34,514	1,303	43,301
May	5,502	5,668	223,820	2,486	108,552	992	40,781	1,314	48,518
June	5,544	5,632	223,481	2,529	104,518	998	48,352	1,280	52,465
July	5,522	5,631	223,124	2,494	98,839	994	58,725	1,264	58,431
August	5,577	5,621	224,211	2,532	95,445	1,038	68,818	1,248	64,096
September	5,435	5,376	228,401	2,416	90,518	961	76,320	1,154	68,005
October	5,632	5,594	234,615	2,490	92,426	1,069	82,920	1,268	72,363
November	5,675	5,672	240,083	2,551	95,589	1,081	83,909	1,277	77,033
December	5,688	5,720	246,199	2,626	103,697	1,106	75,953	1,299	76,942
1949:									
January	5,489	5,623	245,744	2,567	115,598	1,103	66,502	1,255	74,435
February	5,392	5,390	252,708	2,468	124,365	1,038	57,366	1,186	70,616
February, 1949: Changes:									
In Month	—97	—233	+6,964	—99	+8,767	—65	—9,136	—69	—3,819
In One Year	+39	+10	+ 27,828	+204	+ 13,366	—89	+ 22,776	—109	+ 27,460
In Two Years	+582	+570	+ 27,587	+379	+ 20,693	+261	+ 20,465	—42	+ 22,136

Trends

to Receive Additional Cutbacks

Staff Writer

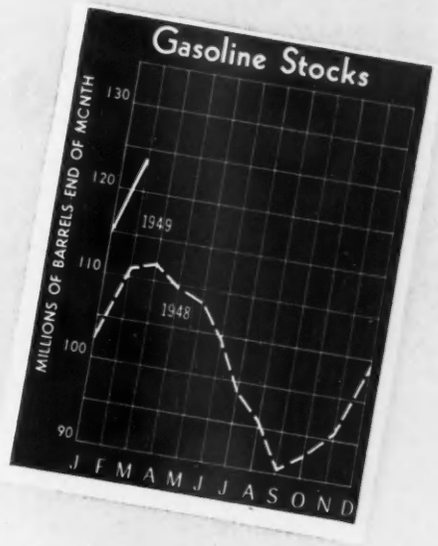
continued growth of stocks others may soon be the scenes of competitive battles.

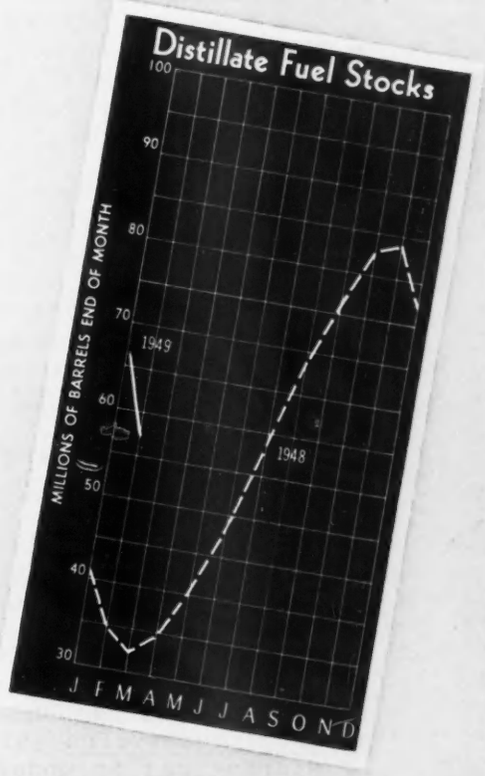
Distillate fuel stocks were lowered to 57,366,000 barrels from 66,502,000 at the end of January, but were still higher than a year previously by 22,776,000 barrels or 66 percent. Demand for distillate fuel in 1949 is forecast to be about 15 percent more than last year's. Because of large stocks, production in February was lowered 65,000 barrels a day from January's output and 89,000 barrels daily from that of February, 1948.

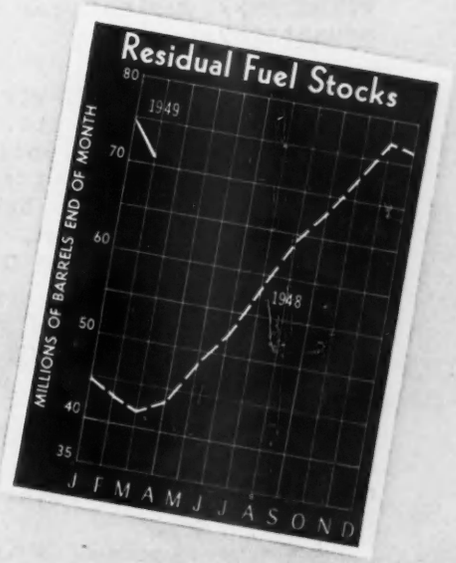
Residual fuel oil production was decreased from the previous month's and was also held under year-ago levels. Stocks dropped from 74,435,000 barrels to 70,616,000 by the end of February. That was 27,460,000 barrels or 63.6 percent more than the 43,156,000 barrels held in storage a year ago. Residual demand in 1949 may differ little from that in 1948.

Crude production was cut 97,000 barrels a day, dropping from 5,489,000 barrels in January to 5,392,000 in February. Despite this cut, stocks of refinable crude continued to climb, gaining 6,964,000 barrels during the month. That boosted the total in storage to 252,708,000 barrels, a level not reached since the middle of 1942. These stocks are becoming so excessive as to cause some anxiety over possibility of a weakening of the crude price structure.

To combat this surplus, state conservation agencies have ordered reductions in crude production allowables for March. This reduced daily output in early March about 190,000 barrels from February's rate.







State Crude Oil Production

(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST TWO MONTHS		
	Feb., 1949	Jan., 1949	Feb., 1948	% Diff. Feb., '48-'49	1949	1948	% Diff. '48-'49
Alabama	1.3	1.3	1.3	.....	74	77	— 3.9
Arkansas	87.9	88.7	87.7	+ 0.2	5,212	5,128	+ 1.6
California	948.5	949.1	933.6	+ 1.6	55,981	55,935	+ 0.1
Colorado	61.9	65.2	43.9	+ 41.0	3,752	2,707	+ 38.6
Florida	1.2	1.3	0.8	+ 50.0	72	47	+ 53.2
Illinois	178.0	181.2	173.9	+ 2.4	10,603	10,377	+ 2.2
Indiana	22.8	24.2	14.1	+ 61.7	1,386	843	+ 64.4
Kansas	273.4	293.2	286.6	— 4.6	16,745	17,277	— 3.1
Kentucky	22.7	24.0	23.7	— 4.2	1,380	1,414	— 2.4
Louisiana	522.5	520.4	476.6	+ 9.6	30,762	28,381	+ 8.4
North Louisiana	122.3	121.0	115.7	+ 5.7	7,176	6,777	+ 5.9
South Louisiana	400.2	399.4	360.9	+ 10.9	23,586	21,604	+ 9.2
Michigan	46.9	46.9	45.1	+ 4.0	2,766	2,709	+ 2.1
Mississippi	109.2	119.5	117.9	— 7.4	6,761	6,945	— 2.6
Missouri	0.2	0.2	0.2	.....	10	10	.....
Montana	24.7	25.3	23.4	+ 5.6	1,476	1,428	+ 3.4
Nebraska	0.3	0.3	0.6	— 50.0	18	34	— 47.1
New Mexico	134.4	134.7	128.0	+ 5.0	7,940	7,552	+ 5.1
New York	14.1	13.9	12.1	+ 16.5	824	726	+ 13.5
Ohio	9.2	8.8	8.1	+ 13.6	532	480	+ 10.8
Oklahoma	420.5	446.7	400.4	+ 5.0	25,623	23,730	+ 8.0
Pennsylvania	30.8	31.5	33.1	— 6.9	1,842	1,982	— 7.1
Tennessee	.....	.....	.....	.....	1	1	.....
Texas	2,339.7	2,364.0	2,396.5	— 2.4	138,797	142,431	— 2.6
Dist. 1—South Central	28.0	27.1	25.7	+ 8.9	1,622	1,537	+ 5.5
Dist. 2—Middle Gulf	158.2	164.8	172.1	— 8.1	9,539	10,202	— 6.5
Dist. 3—Upper Gulf	457.5	468.9	498.4	— 8.2	27,346	29,839	— 8.4
Dist. 4—Lower Gulf-S.W.	222.7	228.9	254.6	— 12.5	13,332	15,310	— 12.9
Dist. 5—East Central	44.9	46.5	44.4	+ 1.1	2,701	2,652	+ 1.8
Dist. 6—Northeast	425.9	410.3	437.5	— 2.7	24,646	25,561	— 3.6
Dist. 7-B—North Central	65.5	62.8	45.1	— 45.2	3,780	2,638	+ 43.3
Dist. 7-C—West Central	49.8	48.5	44.4	+ 12.2	2,898	2,612	+ 10.9
Dist. 8—West	658.8	678.0	663.8	— 0.8	39,463	39,671	— 0.5
Dist. 9—North	138.7	138.9	145.4	— 4.6	8,190	8,630	— 5.1
Dist. 10—Panhandle	89.7	89.3	86.4	+ 3.8	5,280	5,357	— 1.4
Utah	0.2	0.2	.....	.....	9	.....	.....
Virginia	0.1	0.1	0.1	.....	3	4	— 25.0
West Virginia	7.4	7.7	6.9	+ 7.2	447	409	+ 9.3
Wyoming	133.8	141.2	137.9	— 3.0	8,123	8,378	— 3.0
Total United States	5,391.7	5,489.6	5,352.5	+ 0.7	321,139	319,005	+ 0.7

Looking Ahead

● REDUCTION OF U. S. crude production during April to the lowest level in two years probably will mark the low point for oil producing rates for 1949.

● GASOLINE STOCKS, which have attained an all-time peak, should begin declining in April. Consumption of this product always begins climbing toward its summer peak in April, and prospective low production volume assures that April reduction in gasoline stocks will be substantial.

● THE POST of director of the Oil and Gas Division, Department of Interior, vacant for several months, must be filled soon if much of the work of former director Max Ball is not lost. Since several prominent oil men have declined the position, it is probable that a director will be picked in the near future from the staff of OGD itself.

● THE NEXT government cabinet member to resign, according to rumors which are again being circulated rather widely, will be Julius Krug, secretary of the Department of Interior. He is expected to return to private business.

● CONGRESSIONAL ACTION on some of the important pending measures can be expected soon, now that the filibuster against limitation of debate has been concluded.

● NEW STARTLING synthetic rubbers can be expected in the near future. New types will be "custom-made" to meet special requirements of individual products. These developments will go a long way toward assuring that synthetic rubber is not to be driven from world markets by natural rubber.

● IT APPEARS increasingly improbable that the present session of Congress will take any action on the tidelands issue.

● A NEW metal recently introduced by Dupont holds promise of lighter weight and longer-lasting equipment. Tests show it will withstand weathering and chemicals in superior fashion. It is about 40 percent lighter than stainless steel, with a tensile strength of 80,000 to 125,000 pounds per square inch at room temperature.

● LOOK FOR gas companies to increase their efforts to find additional depleted reservoirs suitable for underground gas storage. This practice of storing gas in underground reservoirs during summer months for later withdrawal during peak winter demand has been found to have many advantages.

● PETROLEUM IMPORTS will not be used to supply any substantial part of the U. S. domestic markets. This assurance was given to Governor Beauford Jester of Texas in replies to his letter to heads of importing companies, criticizing increased imports. Assurance that domestic oils will remain principal supply has been given by heads of Gulf Oil Corporation, Shell Union Oil Corporation, The Texas Company, Standard Oil Company of California, Socony-Vacuum Oil Company, Standard Oil Company (New Jersey).

● U. S. EXPORTS of petroleum products henceforth will be virtually free of government restrictions, following lifting of quota limitations by Department of Commerce on April 1.

● ENACTMENT OF proposed processing taxes on petroleum products in Oklahoma or Texas would cause prompt curtailment of refinery operations by numerous plants, declare oil company spokesmen.

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Completions

Follow Seasonal Trends

THE 1949 drilling campaign appears to be following normal seasonal trends and is clearly showing the effects that winter weather always has on U. S. drilling. Some regions have experienced the most severe winter in years and activity in these has been curtailed considerably, but the nation as a whole has held its own very well in comparison with past years.

The number of wells completed in the first two months of this year were only slightly less than those in the same period of 1948. The slow progress made in the first several months of the year is not too indicative of what the year's accomplishments will be, and this was clearly demonstrated last year when a slow start for the first three months gave way to the greatest drilling activity in the industry's history.

In the current year's two-month period 5536 wells were completed to show a very small drop from the 5548 finaled in the same months of last year. A year ago it looked as if 1948 would not live up to expectations of becoming the record drilling year of all times, but after three months of battling rain and snow the industry's drillers began to make up time and the record resulted.

Although total wells completed so far this year lagged slightly behind last year's, there was actually more drilling activity. This is shown by a comparison of the amount of footage drilled. While the difference in the two periods was only 12 wells, the current period succeeded in accounting for almost one million feet more than was drilled in 1948. New wells have averaged 3636 feet each in 1949 against a 3484-foot average a year ago.

Well Completions in the United States during February, 1949, and Cumulative for Year

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from The Producers Monthly)

STATE or DISTRICT	MONTHLY COMPLETIONS, FEBRUARY, 1949 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: Feb., 1949	Jan., 1949	Feb., 1948	Footage Feb., 1949	CUMULATIVE TOTAL: Wells 1949	Wells 1948	Percent Diff.	Footage, 1949	Rigs in Operation (Drilling, Rigging Up and Shut Down): Feb., 1949	Jan., 1949	Feb., 1948
Alabama											1	1		1	2	— 50.0	15,668	5	6	2
Arizona				1				1		1			3,442	1			3,442	6	8	1
Arkansas	14		2	8				24		24	16	21	111,811	40	52	— 23.1	191,441	30	30	31
California	157		1	50				208	5	213	207	202	776,779	420	422	— 0.5	1,600,295	263	295	281
Colorado				1				1		1	3	22	1,678	4	49	— 91.8	14,682	28	23	62
Florida											2	2		2	5	— 60.0	9,316	5	4	5
Georgia																				2
Illinois	88		1	62				151		151	149	178	419,890	300	324	— 7.4	800,187	188	227	193
Indiana	17			37				54		54	77	66	110,266	131	143	— 8.4	256,735	132	122	96
Kansas	107		11	74			1	193		193	199	189	635,257	392	397	— 1.3	1,305,397	277	269	288
Kentucky	22		23	17	1			63		63	77	44	109,259	140	109	+ 28.4	242,289	83	72	69
Louisiana	65	9	7	45				126		126	168	111	753,781	294	256	+ 14.8	1,774,987	202	197	194
North Louisiana	27	1	6	22				56		56	85	72	170,023	141	150	— 6.0	471,362	55	61	56
South Louisiana	38	8	1	23				70		70	83	39	583,758	153	106	+ 44.3	1,303,625	147	136	138
Maryland															1	—100.0				
Michigan	29		1	42				72		72	74	55	164,855	146	112	+ 30.4	337,823	95	104	90
Mississippi	14			10				24		24	21	30	176,475	45	66	— 31.8	319,986	36	35	42
Missouri											1	6		1	6	— 83.3	516	9	9	4
Montana	5			3				8		8	18	21	25,840	26	49	— 46.9	83,030	53	52	46
Nebraska												1			1	—100.0				
Nevada																		1	1	1
New Mexico	31		4	8				43		43	40	50	185,101	83	106	— 21.7	384,837	105	87	124
New York	75				49			124		124	109	147	172,346	233	292	— 20.2	324,099	157	148	159
North Dakota																		1	1	
Ohio	27		20	29				76	2	78	104	71	184,035	182	162	+ 12.3	435,700	161	164	212
Oklahoma	112	2	7	60	3			184	4	188	324	260	736,084	512	615	— 16.7	2,039,396	489	474	553
Pennsylvania	86		34	9	78	16		223		223	252	244	377,233	475	510	— 6.9	843,546	338	344	347
South Dakota																		2	2	1
Tennessee											3	2		3	5	— 40.0	3,458	10	10	19
Texas	536	15	31	282	3	2		869	17	886	1,048	809	3,838,455	1,934	1,680	+ 15.1	8,299,474	1,368	1,366	1,280
Dist. 1—South Central	14			26				40		40	49	40	93,884	89	80	+ 11.3	248,320	44	42	61
Dist. 2—Middle Gulf	20	2	4	19				45	1	46	39	51	276,838	85	122	— 30.3	520,824	59	50	64
Dist. 3—Upper Gulf	43	5		40				88	2	90	123	65	486,741	213	142	+ 50.0	1,265,560	144	143	91
Dist. 4—L. Gulf-S.W.	55	4	5	47				111	3	114	112	92	557,821	226	196	+ 15.3	1,150,177	130	127	125
Dist. 5—East Central	7	2		9	1	1		20		20	26	10	122,346	46	26	+ 76.9	226,961	26	33	34
Dist. 6—Northeast	38	2	3	6				49		49	79	23	224,325	128	62	+106.5	561,311	33	35	49
Dist. 7-B—N. Central	48			32		1		81	1	82	142	102	280,050	224	195	+ 14.9	712,420	194	199	116
Dist. 7-C—W. Central	2			3				5		5	23	31	24,375	28	59	— 52.5	115,691	66	74	67
Dist. 8—West	162		3	18				183	9	192	176	216	970,218	368	415	— 11.3	1,874,832	401	404	451
Dist. 9—North	84			60	2			146	1	147	158	141	449,561	305	300	+ 1.7	861,557	134	125	93
Dist. 10—Panhandle	63		16	22				101		101	121	38	352,296	222	83	+167.5	761,821	137	134	129
Utah				2				2		2	1	2	8,681	3	4	— 25.0	14,831	14	13	12
Virginia												1			1	—100.0				
Washington																				1
West Virginia	4		21	1				26	1	27	55	48	69,506	82	125	— 34.4	229,992	317	336	328
Wyoming	21			10				31		31	54	18	166,818	85	54	+ 57.4	409,471	116	113	99
Total United States	1,410	26	163	752	134	18	1	2,504	29	2,533	3,003	2,601	9,031,164	5,536	5,548	— 0.2	19,944,170	4,491	4,512	4,542

Super-Tankers Threaten U. S. $2 Middle East Oil

By HENRY OZANNE
Staff Writer

NOW that 228,000-barrel capacity super-tankers are coming off the ways, it may become possible in the future for Middle East crude oil to be imported and laid down at U. S. East Coast ports for less than $2 per barrel, even before completion of the Arabian pipe line. Such a figure, however, is strictly a cost estimate, and does not reflect any production or transportation profit.

Since cancellation of the Maritime Commission rate schedule last July, single voyage charter rates to the Persian Gulf have dropped about 15 percent, from around $1.70 to $1.45 a barrel, Ras Tanura to New York. However, in privately operated super-tankers under foreign-flag registry, transportation cost might be brought as low as $1.15 a barrel, including Suez Canal toll of 16 cents a barrel. Or, allowing a 10 cents a barrel profit margin on the marine transportation, hauling charge might be set at $1.25 a barrel.

The U. S. Maritime Commission recently has permitted the transfer of tanker tonnage to foreign-flag registry, with the qualification that the American-registry tonnage so transferred will be made up in new construction. None of the new super-tankers so far launched has been put in Middle East service or even transferred to foreign registry, but there is no reason why these boats could not enter the Persion Gulf run any time their owners so wished.

If super-tankers are placed in Middle East service, the charges in Table 1 may be considered the minimum at which Middle East oil could be put down in New York as against delivery of West Texas crude to the same point.

Thus it appears that Saudi Arabian crude could today be laid down in New York by one of the Aramco partners (Standard Oil Company of California, Standard Oil Company (N. J.), The Texas Company, and Socony-Vacuum Oil Company) for little more than the present actual posted price of West Texas crude, even retaining a 10 cents a barrel transportation profit and the relatively high 97 cents a barrel production profit.

Once the trans-Arabian pipe line is completed and in operation, Middle East crude could be delivered in New York at still lower charge. Assuming completion of the 1040-mile line to terminate at Sidon, Lebanon, and assuming going tanker rates from the Eastern Mediterranean, roughly 20 percent off the former USMC tariff of $1.04 (Haifa to New York), total transportation charges might be reduced a net of about 5 cents a barrel. This is computed by allowing a 30-cent a barrel pipe line operation charge, and assuming Sidon-to-New York tanker operation at a cost of about 85 cents a barrel.

From this point of view the pipe line appears less economically advantageous than it did when USMC rates prevailed. It is conceivable that the savings represented by the pipe line may become even less, posting some reduction in still high wage rates and other operating economies for the super-tankers, and an ample supply of carriers. Further, construction of the pipe line may cost more than originally estimated. In November Aramco announced a "five-year plan" calling for capital expenditure of $520 million, of which $200 million was earmarked for Trans-Arabian Pipe Line Company. While actual construction costs abroad may not be substantially higher by 1952, it is reported there may be some upward revision in royalty and transit right figures. Added charges on the pipe line, either by Saudi Arabia or by Syria or Lebanon, would possibly mean that the line would effect very little if any savings over the tanker haul from Ras Tanura, despite the 2620-mile longer all-water route.

TABLE 1

	Saudi Arabian Crude		
	On Cost Basis	On Profit Basis	West Texas Crude
Actual production cost	$0.20	....	....
Royalty	.23	....	....
Posted price per barrel	....	$1.40*	$2.65
Transportation Ras Tanura-N.Y. by privately-owned "super" tanker under foreign registry	1.15	1.25	....
Transportation U.S. Gulf-N.Y. by privately-owned "super" tanker under U.S. registry	....	....	.30†
Loading and unloading	.05	.05	.05
U.S. import duty	.105	.105	....
Gathering and terminaling	....	....	.25
	$1.735	$2.805	$3.25

* Estimated contract price to Aramco partners; no posted price.

† Current going charter rates, about 20 percent off USMC schedule.

U. S. Reserves at NEW PEAK

By L. J. LOGAN
Associate Editor

PROVED reserves of crude, natural gas liquids, and natural gas in the U. S. reached new all-time peaks at the end of 1948. The year broke all previous records in the proving up of new reserves of liquid hydrocarbons and brought a relatively large proving of new natural gas reserves. Although volumes of production also set records, they were materially exceeded by the proving up of new reserves, and the net additions to proved reserves were relatively large—the largest since 1937 for oil reserves.

By virtue of the success in field development, the nation's reserves of oils were expanded in 1948 in proportion to the year's relatively large increase in production, both reserves and production having been increased somewhat over 8 percent. Consequently, in terms of years' supply at prevailing rates of production, reserves at the end of 1948 were the same as at the end of 1947—11.6 years for crude and 12.3 years for all liquid hydrocarbons.

These are some of the significant facts revealed by the latest annual estimates of reserves by the API and the American Gas Association.

The reports estimated the total reserves of all liquid hydrocarbons in the United States at the end of 1948 at 26,821,227,000 barrels, including 23,280,444,000 barrels of crude oil and 3,540,783,000 barrels of natural gas liquids (condensate, natural gasoline, and liquefied petroleum gases). The total was 2,079,567,000 barrels or 8.4 percent over the total at the end of 1947. This annual increase was the first to exceed 2 billion barrels since that of 2,443,868,000 barrels in 1937.

Production of crude oil and natural gas liquids in the U. S. was estimated at 2,186,197,000 barrels during 1948, an increase of 174,970,000 barrels or 8.7 percent over the preceding year. On the basis of this production in 1948, the proved reserves of all liquid hydrocarbons at the end of the year were equivalent to 12.3 years' production. This was the same as the 12.3 years' production represented by the smaller reserves of the close of 1947 on the basis of the smaller production of 1947.

In compensating for the year's production of more than 2 billion barrels and also providing a net addition of more than 2 billion barrels to liquid hydrocarbon reserves, the industry proved up 4,265,764,000 barrels of new oil reserves in 1948. This was the greatest amount ever proved up in a single year and the only year in history in which 4 billion barrels or more have been blocked out. The 4,265,764,000 barrels of new reserves proved up in 1948 included 3,795,207,000 barrels of crude and 470,557,000 barrels of natural gas liquids (condensate, natural gasoline, and liquefied petroleum gas.)

The best annual record previously in reserve finding was that of 1937, when 3,723,028,000 barrels of reserves were proved up, including crude oil and condensate combined. The only other years when reserves in excess of 3 billion barrels were proved up were 1929 and 1938.

Natural gas reserves were increased substantially in 1948, although by a smaller percentage than reserves of oils. U. S. reserves of natural gas were estimated by the American Gas Association at 173,869,340,000,000 cubic feet as of December 31, 1948. This was an increase of 7,942,426,000,000 cubic feet or 4.8 percent over the 165,926,914,000,000 cubic feet in reserve at the end of 1947. This increase was not quite as large proportionally as the gain in production for the year. Production was estimated at 6,007,628,000,000 cubic feet, an increase of 377,817,000,000 cubic feet or 6.7 percent over the output of 5,629,811,000,000 cubic feet in 1947.

The nation's reserves of nearly 174 trillion cubic feet of gas at the end of 1948 were equivalent to 28.9 years' production at the rate which occurred in 1948. The reserves of nearly 166 trillion

Summary of API Committee's Annual Reports Covering 1937-1948
(BARRELS OF 42 U. S. GALLONS)

Proved Reserves as Reported Prior to 1946

	NEW OIL FOUND DURING YEAR					
	Through Revisions of Previous Estimates and Extensions to Known Fields (1)	Through Discoveries of New Fields and of New Pools in Old Fields (2)	Total Through New Discoveries, Extensions and Revisions (Columns 1+2) (3)	Production During Year (See Footnote at Bottom of Page 2) (4)	Estimated Proved Reserves as of End of Year (Column 3-4) (5)	Increase Over Previous Year (6)
1936					13,063,400,000	
1937	2,792,790,000	928,742,000	3,721,532,000	1,277,664,000	15,507,268,000	2,443,868,000
1938	2,243,571,000	810,493,000	3,054,064,000	1,213,186,000	17,348,146,000	1,840,878,000
1939	2,058,455,000	340,667,000	2,399,122,000	1,264,256,000	18,483,012,000	1,134,866,000
1940	1,607,012,000	286,338,000	1,893,350,000	1,351,847,000	19,024,515,000	541,503,000
1941	1,538,989,000	429,974,000	1,968,963,000	1,404,182,000	19,589,296,000	564,781,000
1942	1,618,925,000	260,051,000	1,878,976,000	1,385,479,000	20,082,793,000	493,497,000
1943	1,202,368,000	282,418,000	1,484,786,000	1,503,427,000	20,064,152,000	(—) 18,641,000
1944	1,556,192,000	511,308,000	2,067,500,000	1,678,421,000	20,453,231,000	389,079,000
1945	1,690,315,000	419,984,000	2,110,299,000	1,736,717,000	20,826,813,000	373,582,000
December 31, 1945 Estimated Proved Reserves of Crude Oil Only (see note below)					19,941,846,000	

Note: Up to and including its figures on proved reserves of petroleum, as of December 31, 1945, the committee combined under that heading the estimated proved reserves of cycle-plant and lease condensate. As of December 31, 1945, the reserves so included totaled 884, 967,000 bbl. and as of December 31, 1944 there were 668,701,000 bbl. included. Beginning with the report of December 31, 1946, the figures in this table show crude oil and natural gas liquids. It is to be remembered that, previous to December 31, 1946, not all classes of natural gas liquids were included. For this reason the totals for crude oil and natural gas liquids, as herewith recorded for 1946, 1947 and 1948, are not comparable with the figures recorded for years prior to 1946.

Proved Reserves as Reported for 1946 and Thereafter

Crude Oil Only

1946	2,413,628,000	244,434,000	2,658,062,000	1,726,348,000	20,873,560,000	931,714,000
1947	2,019,140,000	445,430,000	2,464,570,000	1,850,445,000	21,487,685,000	614,125,000
1948	3,398,726,000	396,481,000	3,795,207,000	2,002,448,000	23,280,444,000	1,792,759,000

Natural Gas Liquids Only

1946	(This detail not available for 1946)				3,163,219,000	
1947	192,237,000	59,301,000	251,538,000	160,782,000	3,253,975,000	90,756,000
1948	405,874,000	64,683,000	470,557,000	183,749,000	3,540,783,000	286,808,000

Total Liquid Hydrocarbons

1946	(This detail not available for 1946)				24,036,779,000	
1947	2,211,377,000	504,731,000	2,716,108,000	2,011,227,000	24,741,660,000	704,881,000
1948	3,804,600,000	461,164,000	4,265,764,000	2,186,197,000	26,821,227,000	2,079,567,000

cubic feet at the end of 1947 were equivalent to 28.4 years' production at the 1947 rate.

The estimates of oil reserves refer only to proved or blocked-out reserves. They include only oil and natural gas liquids recoverable under existing economic and operating conditions. The estimates do not include oil under the unproved portions of partly developed fields; oil in untested prospects; oil that may be present in unknown prospects in regions believed to be generally favorable; oil that may become available by secondary recovery methods from fields where such methods have not yet been applied; oil that may become available through chemical processing of natural gas; oil that can be made from oil shale, coal, or other substitute sources.

Proved reserves are both drilled and undrilled. The proved drilled reserves in any pool include the oil estimated to be

Summary of Changes in 1948 in Proved U. S. Reserves of Crude Oil, Natural Gas Liquids, and Total Liquid Hydrocarbons

(All Oils)

Estimates on crude oil from American Petroleum Institute; and on natural gas liquids and total liquid hydrocarbons from American Gas Association and American Petroleum Institute, working together.

(Barrels of 42 U. S. Gallons)

CRUDE OIL	
Total proved reserves of crude oil as of December 31, 1947	21,487,685,000
Revisions of previous estimates	+1,958,853,000
Extensions of old pools	1,439,873,000
New Reserves (new pools) discovered in 1948	396,481,000
Proved reserves added in 1948	3,795,207,000
Total proved reserves as of December 31, 1947 plus new proved reserves added in 1948	25,282,892,000
Less production during 1948*	2,002,448,000
Total proved reserves of crude oil as of December 31, 1948	23,280,444,000
Increase in crude oil reserves during 1948	1,792,759,000
NATURAL GAS LIQUIDS	
Total proved reserves of natural gas liquids as of December 31, 1947	3,253,975,000
Revisions of previous estimates and extensions of old pools	+405,874,000
New reserves (new pools) discovered in 1948	64,683,000
Proved reserves added in 1948	470,557,000
Total proved reserves as of December 31, 1947 plus new proved reserves added in 1948	3,724,532,000
Less production during 1948*	183,749,000
Total proved reserves of natural gas liquids as of December 31, 1948	3,540,783,000
Increase in Natural Gas Liquids reserves during 1948	286,808,000
TOTAL LIQUID HYDROCARBONS	
Total proved reserves as of December 31, 1947	24,741,660,000
Revisions of previous estimates and extensions of old pools	+3,804,600,000
New reserves (new pools) discovered in 1948	461,164,000
Proved reserves added in 1948	4,265,764,000
Total proved reserves as of December 31, 1947, plus new proved reserves added in 1948	29,007,424,000
Less production during 1948*	2,186,197,000
Tota /proved reserves of liquid hydrocarbons as of December 31, 1948	26,821,227,000
Increase in Total Liquid Hydrocarbon reserves during 1948	2,079,567,000

Estimated Proved Reserves of Crude Oil, Natural Gas Liquids, and Total Liquid Hydrocarbons in the United States

(Sources: Crude oil by API Committee; natural gas liquids and total liquid hydrocarbons by API and AGA Committees.)

(BARRELS OF 42 U. S. GALLONS)

	Proved Reserves as of December 31, 1947 (1)	Changes in Proved Reserves Due to Extensions (New Oil) and Revisions During 1948 (2)	[1]Proved Reserves Discovered in New Fields and in New Pools in Old Fields in 1948 (3)	[2]Production During 1948 (See Footnote at Bottom of Page 2) (4)	Proved Reserves as of December 31, 1948 (Columns 1+2+3 Less Column 4) (5)	Changes in Reserves During 1948 (Column 5 Less Column 1) (6)
Crude Oil—						
Alabama	2,759,000	1,264,000		476,000	3,547,000	788,000
Arkansas	296,908,000	29,990,000	3,247,000	30,103,000	300,042,000	3,134,000
California	3,294,963,000	750,614,000	58,075,000	340,069,000	3,763,583,000	468,620,000
Colorado	381,882,000	255,000	350,000	17,029,000	365,458,000	(—) 16,424,000
Illinois	355,361,000	91,748,000	9,103,000	62,847,000	393,365,000	38,004,000
Indiana	46,015,000	5,892,000	5,129,000	7,957,000	49,079,000	3,064,000
Kansas	562,678,000	199,878,000	19,922,000	108,083,000	674,395,000	111,717,000
Kentucky	64,550,000	1,988,000	1,305,000	8,634,000	59,209,000	(—) 5,341,000
Louisiana	1,791,004,000	201,728,000	51,361,000	174,803,000	1,869,290,000	78,286,000
Michigan	69,714,000	9,894,000	6,667,000	16,892,000	69,383,000	(—) 331,000
Mississippi	303,677,000	91,962,000	13,434,000	43,627,000	365,446,000	61,769,000
Montana	114,662,000	12,258,000	1,550,000	9,526,000	118,944,000	4,282,000
Nebraska	866,000	235,000		236,000	865,000	(—) 1,000
New Mexico	530,483,000	61,017,000	8,083,000	47,352,000	552,231,000	21,748,000
New York	71,519,000			4,403,000	67,116,000	(—) 4,403,000
Ohio	28,994,000	3,454,000		3,906,000	28,542,000	(—) 452,00
Oklahoma	952,990,000	412,886,000	39,746,000	155,221,000	1,250,401,000	297,411,000
Pennsylvania	122,720,000			12,914,000	109,806,000	(—) 12,914,000
Texas	11,777,537,000	1,450,188,000	155,804,000	899,311,000	12,484,218,000	706,681,000
West Virginia	36,092,000	3,200,000	100,000	2,695,000	36,697,000	605,000
Wyoming	679,311,000	70,656,000	21,780,000	55,960,000	715,787,000	36,476,000
[3]Miscel.	3,000,000	(—) 381,000	825,000	404,000	3,040,000	40,000
Total U.S.	21,487,685,000	[4]3,398,726,000	396,481,000	2,002,448,000	23,280,444,000	1,792,759,000
[5]Natural Gas Liquids—						
[6]Alabama						
Arkansas	58,259,000	3,220,000	249,000	4,271,000	57,457,000	(—) 802,000
California	312,151,000	20,088,000	2,149,000	26,480,000	307,908,000	(—) 4,243,000
Colorado	7,942,000	27,834,000	537,000	14,000	36,299,000	28,357,000
Illinois	17,920,000	10,152,000		3,910,000	24,162,000	6,242,000
Indiana	65,000	71,000		28,000	108,000	43,000
Kansas	88,812,000	15,621,000	17,000	2,106,000	102,344,000	13,532,000
Kentucky	15,344,000	410,000	206,000	1,559,000	14,401,000	(—) 943,000
Louisiana	462,814,000	67,206,000	16,113,000	22,037,000	524,096,000	61,282,000
Michigan	1,065,000	53,000	59,000	111,000	1,066,000	1,000
Mississippi	58,659,000	721,000	942,000	2,758,000	57,564,000	(—) 1,095,000
Montana	1,360,000	2,840,000		200,000	4,000,000	2,640,000
New Mexico	85,922,000	(—) 5,756,000	4,342,000	4,261,000	80,247,000	(—) 5,675,000
[6]New York						
Ohio	1,736,000	70,000	9,000	151,000	1,664,000	(—) 72,000
Oklahoma	155,003,000	53,685,000	8,225,000	16,525,000	200,388,000	45,385,000
Pennsylvania	2,236,000	467,000	233,000	291,000	2,645,000	409,000
Texas	1,957,063,000	180,126,000	31,204,000	93,719,000	2,074,674,000	117,611,000
West Virginia	17,521,000	1,076,000	359,000	3,742,000	15,214,000	(—) 2,307,000
Wyoming	9,900,000	27,971,000		1,564,000	36,307,000	26,407,000
[7]Miscel.	203,000	19,000	39,000	22,000	239,000	36,000
Total U.S.	3,253,975,000	405,874,000	64,683,000	183,749,000	3,540,783,000	286,808,000
LiquidHydrocarbons—						
[8]Alabama	2,759,000	1,264,000		476,000	3,547,000	788,000
Arkansas	355,167,000	33,210,000	3,496,000	34,374,000	357,499,000	2,332,000
California	3,607,114,000	770,702,000	60,224,000	366,549,000	4,071,491,000	464,377,000
Colorado	389,824,000	28,089,000	887,000	17,043,000	401,757,000	11,933,000
Illinois	373,281,000	101,900,000	9,103,000	66,757,000	417,527,000	44,246,000
Indiana	46,080,000	5,963,000	5,129,000	7,985,000	49,187,000	3,107,000
Kansas	651,490,000	215,499,000	19,939,000	110,189,000	776,739,000	125,249,000
Kentucky	79,894,000	2,398,000	1,511,000	10,193,000	73,610,000	(—) 6,284,000
Louisiana	2,253,818,000	268,934,000	67,474,000	196,840,000	2,393,386,000	139,568,000
Michigan	70,779,000	9,947,000	6,726,000	17,003,000	70,449,000	(—) 330,000
Mississippi	362,336,000	92,683,000	14,376,000	46,385,000	423,010,000	60,674,000
Montana	116,022,000	15,098,000	1,550,000	9,726,000	122,944,000	6,922,000
Nebraska	866,000	235,000		236,000	865,000	(—) 1,000
New Mexico	616,405,000	55,261,000	12,425,000	51,613,000	632,478,000	16,073,000
[8]New York	71,519,000			4,403,000	67,116,000	(—) 4,403,000
Ohio	30,730,000	3,524,000	9,000	4,057,000	30,206,000	(—) 524,000
Oklahoma	1,107,993,000	466,571,000	47,971,000	171,746,000	1,450,789,000	342,796,000
Pennsylvania	124,956,000	467,000	233,000	13,205,000	112,451,000	(—) 12,505,000
Texas	13,734,600,000	1,630,314,000	187,008,000	993,030,000	14,558,892,000	824,292,000
West Virginia	53,613,000	4,276,000	459,000	6,437,000	51,911,000	(—) 1,702,000
Wyoming	689,211,000	98,627,000	21,780,000	57,524,000	752,094,000	62,883,000
[9]Miscel.	3,203,000	(—) 362,000	864,000	426,000	3,279,000	76,000
Total U.S.	24,741,660,000	3,804,600,000	461,164,000	2,186,197,000	26,821,227,000	2,079,567,000

[1] Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce; for in this report the concern is only with actually proved reserves.

[2] The 1948 production figures were compiled by the committee and are based on 11 months actual production with an estimate for December. Any variance between the actual production, as later reported, and the figures used herein will be compensated for through revision when the following year's reserve report is compiled. These revisions have in the past been very small.

[3] Includes Florida, Missouri, Tennessee, Utah, and Virginia.

[4] Includes 1,439,873,000 bbls. of extensions to old pools and upward revision of 1,958,853,000 bbls. in previous estimates.

[5] Condensate, natural gasoline, and liquefied petroleum gases.

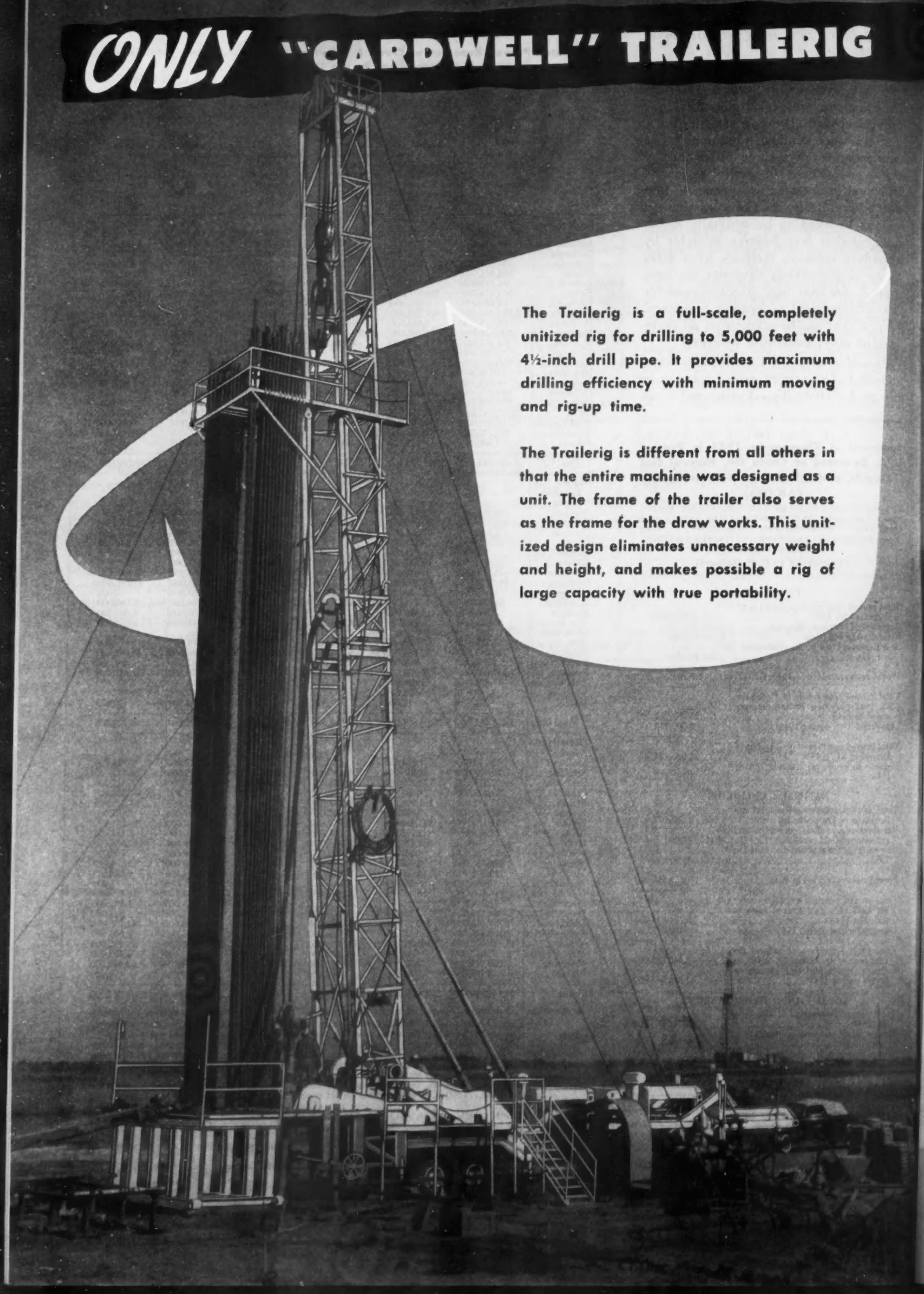
[6] Included below with Miscellaneous.

[7] Includes Alabama, Florida, New York, and Utah.

[8] Crude oil only; natural gas liquids not separable from miscellaneous grouping in data on natural gas liquids.

[9] Includes Alabama and New York natural gas liquids; Missouri, Tennessee, and Virginia crude; Florida and Utah crude and natural gas liquids.

ONLY "CARDWELL" TRAILERIG

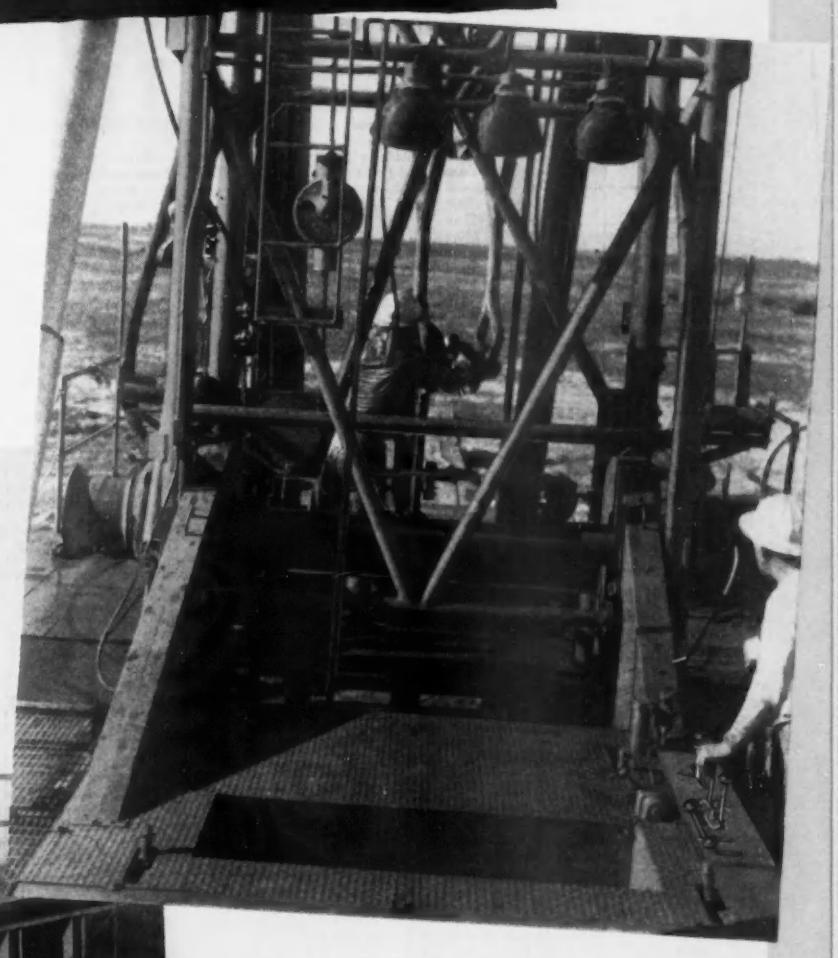


The Trailerig is a full-scale, completely unitized rig for drilling to 5,000 feet with 4½-inch drill pipe. It provides maximum drilling efficiency with minimum moving and rig-up time.

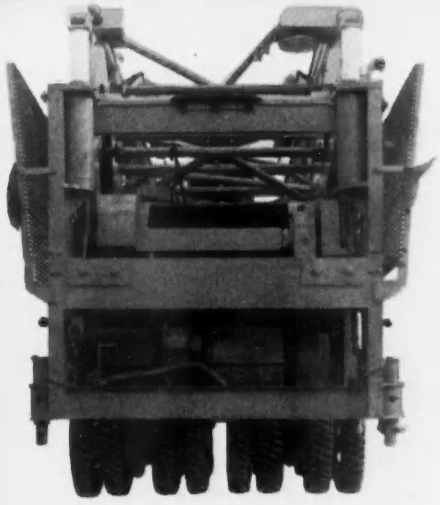
The Trailerig is different from all others in that the entire machine was designed as a unit. The frame of the trailer also serves as the frame for the draw works. This unitized design eliminates unnecessary weight and height, and makes possible a rig of large capacity with true portability.

has all these features!

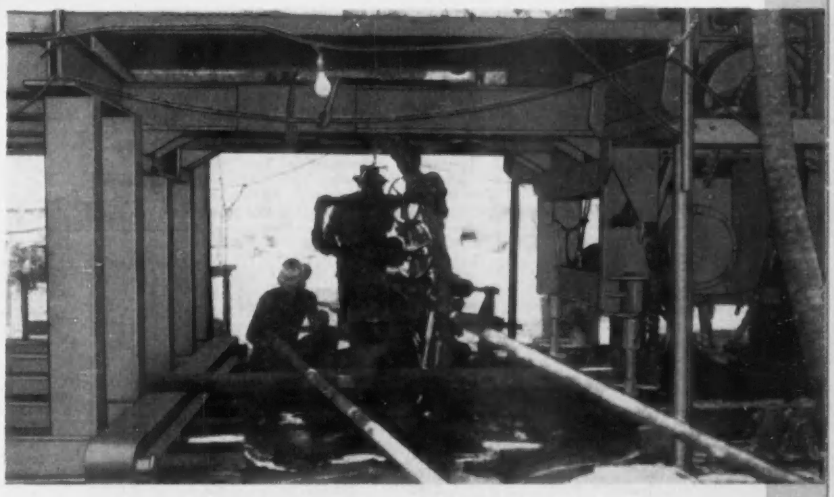
Clear vision and real safety for the driller is a feature of the Trailerig. The driller stands behind the cathead and has a good view of the table and racking platform. Finger-tip air controls give the driller effortless and positive control of all draw works operations.



The 16-foot square working platform, all in the clear, gives the crew a lot of space to work in safety and comfort. The built-in rathole digger saves time on every well.



The Trailerig is only 8 feet wide, 13½ feet high and 59 feet long. This highly portable rig is carried on 16 tires mounted on articulated axles to provide even distribution of weight on all tires. Athey tracks are available for extreme conditions.



Ample space under the rotary table is of vital importance on drilling and workover jobs. The Trailerig has 64 inches to the bottom of the support beams, and 10 additional inches to the bottom of the rotary table. This provides enough space for blowout preventers and wellhead connections. The well is readily accessible from either side.

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WHEN IT'S A "CARDWELL," THERE'S NO EQUAL IN QUALITY

Estimated Proved Recoverable Reserves of Natural Gas Liquids in the United States

Includes condensate, natural gasoline, and liquefied petroleum gas
(THOUSANDS OF BARRELS)

STATE	Reserves as of Dec. 31, 1947	CHANGES IN RESERVES DURING 1948			RESERVES AS OF DECEMBER 31, 1948			
		Extensions and Revisions	Discoveries of New Fields in Old Pools	Net Production	TOTAL	Non-Associated	Associated	Dissolved
Arkansas	58,259	3,220	249	4,271	57,457	36,468	7,926	13,063
California	312,151	20,088	2,149	26,480	307,908	.....	103,259	204,649
Colorado	7,942	27,834	537	14	36,299	537	.....	35,762
Illinois	17,920	10,152	.....	3,910	24,162	40	100	24,022
Indiana	65	71	.....	28	108	30	.....	78
Kansas	88,812	15,621	17	2,106	102,344	97,695	2,539	2,110
Kentucky	15,344	410	206	1,559	14,401	*14,401	.....	.....
Louisiana	462,814	67,206	16,113	22,037	524,096	382,319	95,908	45,869
Michigan	1,065	53	59	111	1,066	607	.....	459
Mississippi	58,659	721	942	2,758	57,564	24,563	27,641	5,360
Montana	1,360	2,840	.....	200	4,000	.....	4,000	.....
New Mexico	85,922	(—)5,756	4,342	4,261	80,247	23,879	30,902	25,466
Ohio	1,736	70	9	151	1,664	*1,664	.....	.....
Oklahoma	155,003	53,685	8,225	16,525	200,388	95,869	16,436	88,083
Pennsylvania	2,236	467	233	291	2,645	*2,645	.....	.....
Texas	1,957,063	180,126	31,204	93,719	2,074,674	1,314,800	297,052	462,822
Utah	200	.....	30	21	209	209	.....	.....
West Virginia	17,521	1,076	359	3,742	15,214	*15,214	.....	.....
Wyoming	9,900	27,971	.....	1,564	36,307	12,191	.....	24,116
†Miscellaneous	3	19	9	1	30	24	.....	6
Total	3,253,975	405,874	64,683	183,749	3,540,785	2,023,155	585,763	931,865

* Not allocated by types, but occurring principally in column shown.
† Includes Alabama, Florida, Missouri, Nebraska, New York and Virginia.

Summary of Annual Estimates of U. S. Reserves of Natural Gas and Natural Gas Liquids

(Natural Gas data in Millions of Cubic Feet—14.65 psia, at 60° F.)
(Natural Gas Liquids in Thousands of Barrels of 42 U. S. Gallons.)

YEAR	ADDED DURING YEAR			Net Change in Storage	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
	Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions and Extensions				
Natural Gas:							
1945	.....	.....	.....	.....	.....	147,789,367	.....
1946	*	*	17,729,152	*	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	*	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
Natural Gas Liquids:							
1946	.....	.....	.....	.....	129,262	3,163,219	.....
1947	192,237	59,301	251,538	.....	160,782	3,253,975	90,756
1948	405,874	64,683	470,557	.....	183,749	3,540,783	286,808

* Not estimated.

recoverable by the production systems now in operation, primary or secondary, and from the area actually drilled up on the spacing pattern in vogue in that pool. The proved undrilled reserves in any pool include reserves under undrilled spacing units which are so close and so related to the drilled units that there is every reasonable probability that they will produce when drilled.

The total quantity of new reserves proved up during any year includes oil from discoveries of new fields or pay horizons, extensions of such reservoirs, and revisions of earlier estimates.

The total of new oil through discoveries estimated as proved in any given year is generally comparatively small, because development is usually not extensive during the first year. The new oil proved through extensions, on the other hand, is comparatively large. As knowledge of factors affecting production and reservoir performance becomes available, and as these factors are studied, reserves in older fields can be estimated with greater precision and revised accordingly.

Summary of U. S. Reserves of Natural Gas
(Thousands of Cubic Feet)

Total proved reserves as of Dec. 31, 1947	165,926,914,000
Extensions and revision of previous estimate	9,769,483,000
New reserves discovered in 1948	4,129,089,000
Net changes in "stored gas" during 1948	51,482,000
Total proved reserves added and net changes in "stored gas" during 1948	13,950,054,000
Total proved reserves as of Dec. 31, 1947 and additions during 1948	179,876,968,000
Deduct production during 1948	6,007,628,000
Total proved reserves of natural gas as of Dec. 31, 1948	173,869,340,000

Estimated Proved Recoverable Reserves of Natural Gas in the United States
(Millions of Cubic Feet—14.65 psia, at 60° F.)

STATE	Reserves as of Dec. 31, 1947	CHANGES IN RESERVES DURING 1948 (b)				RESERVES AS OF DECEMBER 31, 1948 (b)				
		Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Net Change in Underground Storage (c)	Net Production (d)	TOTAL	Non-Assoc. (e)	Associated (f)	Dissolved (g)	Underground Storage (h)
Arkansas	890,149	73,969	3,484	(—) 10	65,754	901,838	457,906	161,919	280,568	1,445
California	10,164,356	498,673	111,257	(—) 2,699	578,994	10,192,593	2,911,991	3,052,802	4,215,775	12,025
Colorado	331,866	621,577	408,148	.....	12,412	1,349,179	586,757	40,939	721,483	.....
Illinois	221,131	43,310	.....	.....	36,637	227,804	7,967	20,000	199,837	.....
Indiana	13,000	14,104	.....	.....	5,504	21,600	6,000	.....	15,600	.....
Kansas	14,556,916	124,304	2,385	1,213	276,986	14,407,832	13,959,636	210,292	211,035	26,869
Kentucky	1,379,480	69,775	9,000	7,896	88,000	1,378,151	1,295,122	.....	73,000	10,029
Louisiana	23,481,233	532,638	722,859	.....	759,210	23,977,520	18,909,691	3,490,004	1,577,825	.....
Michigan	168,469	14,490	11,705	10,461	22,138	182,987	121,502	.....	45,876	15,609
Mississippi	2,452,760	54,413	52,423	.....	55,260	2,504,336	1,743,948	464,632	295,756	.....
Montana	700,510	189,244	1,966	1,575	40,690	852,605	485,030	337,121	28,879	1,575
New Mexico	5,990,283	(—)214,670	108,930	989	279,171	5,606,361	2,824,102	1,991,862	786,557	3,840
New York	64,900	4,098	.....	3,073	4,456	67,615	59,720	.....	725	7,170
Ohio	611,200	57,780	7,880	13,325	60,732	629,453	542,608	.....	38,500	48,345
Oklahoma	11,350,864	447,543	208,636	(—) 283	674,315	11,332,445	7,660,624	1,125,136	2,534,088	12,597
Pennsylvania	483,063	182,967	12,000	13,972	74,592	617,410	530,721	.....	45,750	40,939
Texas	90,025,566	6,563,060	1,830,349	.....	2,710,422	95,708,553	68,663,367	16,725,023	10,320,163	.....
Utah	66,670	.....	10,000	.....	6,872	69,798	69,798	.....	.....	.....
West Virginia	1,780,735	123,462	37,000	1,970	206,000	1,737,167	1,622,235	.....	89,500	25,432
Wyoming	1,191,788	363,063	588,067	.....	49,178	2,093,740	927,796	257,308	908,636	.....
Miscellaneous (a)	1,975	5,683	3,000	.....	305	10,353	7,993	.....	2,360	.....
Total	165,926,914	9,769,483	4,129,089	51,482	6,007,628	173,869,340	123,394,514	27,877,038	22,391,913	205,875

(a) Includes Alabama, Florida, Missouri, Nebraska and Virginia.
(b) Excludes shrinkage caused by natural gas liquids recovery.
(c) The net difference between gas stored in and gas withdrawn from underground storage reservoirs.
(d) Net production equals gross withdrawals less gas injected into undergound reservoirs; changes in underground storage are excluded
(e) Non-associated gas is free gas not in contact with crude oil in the reservoirs.
(f) Associated gas is free gas in contact with crude oil in the reservoirs.
(g) Dissolved gas is gas in solution with crude oil in the reservoirs.
(h) Gas held in undergound reservoirs for storage purposes only.

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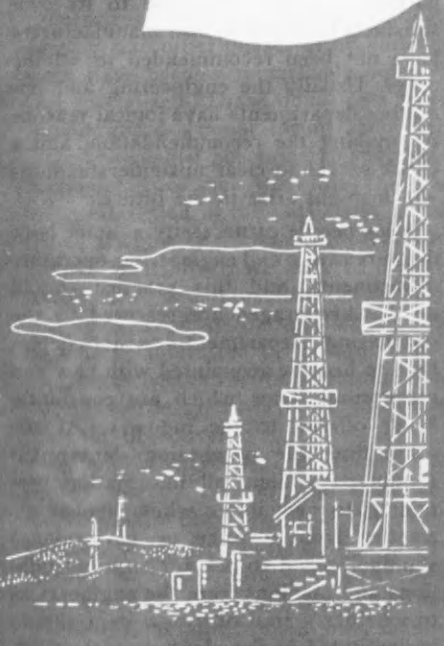

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Relationship Between Purchasing and Operating Departments

By OWEN D. STORY
Shell Oil Company, Houston

FUNCTIONS of an oil company's purchasing and operating departments are so closely interwoven that the relationship of one to the other should be clearly defined to insure the utmost economy and efficiency in company practice. For example, it should be understood that an operating department is not qualified by experience and training to handle purchasing matters and conversely a purchasing department should not presume to handle matters which are a direct function of engineering and operating.

It is impractical for a purchasing department in an oil company to have a diversified staff qualified to make final selection of the materials required by the company, and therefore this duty properly devolves upon engineers in operating departments, who, with their specialized training and technique, can investigate and determine the adaptability of various items necessary to operations.

Not infrequently operating departments conduct periodic surveys pertaining to various standard equipment items. In effect, such surveys are quite unnecessary since it is generally considered that standard manufacturers make an equal product even though constant surveys might show some slight difference. This applies particularly to such standard equipment as tubular goods, sucker rods, wire lines, general valves and fittings, cement, mud and mud chemicals, etc. The selection of the supplier and the manufacturer of these commodities devolves upon the purchasing department, although final decision must be the result of cooperating with the engineering and operating departments and generally based on the principle that only standard manufactured articles, and not unknown merchandise, be accepted. This does not imply that new items should not be investigated, but if new designs or types are presented to the purchasing department, the latter should clear such material with the engineering department before issuing a purchase order. In this way both departments can keep abreast of new developments and maintain harmonious relationship in their respective spheres of action.

About the Author

OWEN D. STORY, manager of Regional Purchasing - Stores for Shell Oil Company, Inc., Houston, has spent a working lifetime grappling with oil company purchasing problems. His ability in this endeavor last year brought about his election as National Chairman of the Oil Buyers' Group in the U. S. Story joined the Shell group in the Purchasing department and has been continuously employed for 26 years by the company. His assignments have included duties as division warehouseman, division storekeeper and area Purchasing-Stores representative.

In actual practice the engineering and operating departments of an oil company generally specify the brand name on mechanical equipment, drilling rigs, boilers, derricks, pumps, engines, electrical motors and similar equipment, selection being governed by the most efficient application to the job in hand. Following the selection, the requisition specifying in complete detail the article required is passed along to the purchasing department, which should adhere strictly to the requisition. However, the purchasing department may procure the article from any one of several suppliers without referring the matter to the engineering or operating departments.

The purchasing department should also have full responsibility in selection of materials to the extent that if items have been specified which are not generally accepted by the industry the department should determine to its own satisfaction why standard manufacturers have not been recommended to fill the order. Usually the engineering and operating departments have logical reasons for making the recommendation, and a check serves to clear misunderstandings which might arise in the future.

Sales people of necessity contact both the purchasing and engineering-operating departments, and this practice should not be discouraged nor resented by the purchasing department, as it enables both to become acquainted with new and meritorious items which are constantly being offered to the industry. At the same time the purchasing department should pass along all information pertaining to new items which appear attractive from a price or performance standpoint and to ask for recommendations and opinions from the engineers as to whether a trial of a new item should be instituted in the plant or in the field.

Close cooperation should obtain between both departments in the matter of specifications on requisitions, which should be complete and clear. Where engineering specifications for several equipment items are more or less identical, the purchasing department should sub-

■ CONTINUED ON PAGE 62

The Greeks Had a Word for It

By REESE H. TAYLOR
President, Union Oil Company of California

THE fifth century Greeks recognized the dangers of specialization. They strived for a well-rounded life. Their word for specialization, which has no counterpart in English, was **banausía** (pronounced bah-now-sée-a). It denoted the state of a person who concentrated on one specialty to the point where his development as an all 'round personality suffered.

Are you in the petroleum industry well-rounded in your business life?

Petroleum geology, petroleum engineering, and other phases of oil industry work have become remarkably complex and specialized. Those doing this work should guard against losing their perspective—against becoming so engrossed in the details of their work that they fail to be interested in the petroleum industry as a whole or aware of the real purpose of their effort, which is to provide power, heat, and transportation for people. It is a pitfall of specialization to become so interested in techniques that the means become more important than the ends—the methods more important than the objectives.

In the early 1900's oil companies still leaned heavily on versatile men who were equally capable in exploration, drilling, and production. Such men would personally find places to drill, lease up the land themselves, make their own locations, direct their own drilling operations, supervise the completion of the wells, and help the pumpers with their production problems. Those old-timers managed to bring in Santa Fe Springs, Lost Hills, Lakeview, Brea Olinda, and many other fields.

Today, the corresponding operations are handled with more science but too often with less perspective among the men doing the work. If the vice president in charge of field operations persuades the executive committee that the company should explore a new area, the development is carried out in the modern way, which makes much use of specialization and specialists. The vice president outlines the project to the chief geologist. The chief geologist gets a set of aerial photographs made of the area. Then he hands these photographs over to a specialist in photogrammetry. Let's say the study shows the area to be a deep sedimentary basin with several interesting structural features. The chief geologist then sends one of his field geologists into the area to map the structures.

The field geologist finally turns in a report which consists of 70 typewritten pages and 22 maps and sections of the structural features mapped on various horizons.

The report shows that some of the structures have too much closure, others have too little; some are noses and lack closures entirely; some are badly faulted and still others are overlain by thick sections of continental beds. It ends with a recommendation that a detailed study of the area be made by a micropaleontologist.

So the micropaleontologist goes out and takes samples from outcrops and core holes. He draws up a paleogeographic map to show the extent of ancient seas that invaded the area and studies hundreds of samples. After that he turns in a five-pound report which lists each foram by name and contains several pages of symbols that even the chief geologist can't understand.

With the help of a few translators and interpreters, however, the geological department decides that the paleontology report indicates that facies changes are present. This suggests that the formations under the structures mapped by the field geologist may be too tight to contain oil. The best areas may be in the flatter country between these structures. Consequently, on the recommendation of the micropaleontologist they decide that the area should be further explored by geophysical methods.

The flying magnetometer is employed over the area and the results suggest the presence of a basement ridge. Consequently the magnetometer expert rec-

OIL INDUSTRY operations have become remarkably complex, technical, and specialized. Specialized skills and knowledge are essential in the industry's operations and development.

Employes doing specialized work in the industry should guard against losing their perspective. They should not become so engrossed in the details of their work that they fail to be interested in the petroleum industry as a whole.

This article is from a talk at the annual banquet of the petroleum division, AIME, at San Francisco, February 15, 1949.

ommends that this area be further checked with a gravity meter to determine the extent and shape of the ridge.

The specialist in gravity interpretation submits a map contoured on equal density which shows an anomaly that he suggests indicates the presence of a basement ridge. Then two days later he submits a second map of the same area which is based on the second derivative and suggests that the ridge is not present at all. After dropping this bombshell he recommends that the area be shot by reflection seismograph.

The reflection seismograph party moves into the area and shoots a number of profiles. They submit maps and cross-sections which indicate that the area where the basement ridge is supposed to be is actually low. Furthermore, some of the structures previously mapped are complicated by faulting which occurs at depth but is not recognizable at the surface. They recommend that further work be done in the area.

At this point the chief geologist looks over all the reports again and finally decides that the first structure mapped might be just as good as any of the others. So he refers the subject to the land department for leasing.

The lease man contacts the land owner. The land owner calls in his lawyer. The lawyer requests a tax expert. The tax expert, anticipating inheritance taxes, decides he needs a valuation engineer to estimate the amount and value of the oil and gas that may be under the land. The valuation engineer finds he needs an expert gas man to aid in figuring the gas reserves, a petroleum engineer to help in figuring reservoir pressures, and an expert in unitization procedure to determine the percentage likely to be realized under unit operation.

A title man is called in to pass on the title, and an expert on rights-of-way to interpret some obscure clauses regarding trespass.

Finally the lease is completed and sent through the usual channels to be documented.

Then the vice president in charge of field operations comes back to the executive committee for an appropriation to drill. By this time, naturally, the executive committee is several years older and has forgotten most of the details of the deal. But after wading through several pounds of reports they appropriate the money.

The vice president in charge of field operations calls in the chief geologist and tells him to make the location. The chief geologist calls a consultation of his various specialists and they spread out their maps and begin to discuss the location of the well.

The field geologist, naturally, wants to drill on top of the structure he mapped. The paleontologist wants to move the location 100 feet to the east because of facies changes.

The geophysicist wants to move it 200 feet north because of velocity gradients.

The land man thinks it should be 100 feet south because of the offset clause in the lease.

The lawyer drops in and thinks it ought to be moved further west to insure a more suitable position for unitization.

At this point the vice president happens to come by, takes a look, stabs his finger at the map and says, "Nuts—let's drill here."

So the surveyor is called in and told to drive a stake at the chosen location.

Situation Normal

A few days later, the manager of operations, drilling superintendent, division petroleum engineer, drilling contract supervisor and mud engineer drive out to the location to make the necessary layout on the ground.

Things proceed with just about the normal amount of confusion for a day or two and then the lease supervisor suddenly reminds everyone that the lease carries an obligation to spud within one week.

This throws the whole department into a tailspin, but after a week of overtime the well is spudded.

In the meantime the petroleum engineer on the job has been setting up his drilling program, including a design for the casing to be run in the well.

But when he delivers it neatly typed, blueprinted and packaged, the purchasing agent informs him that those pipe sizes are unavailable. So the design is thrown out and the tool pusher figures out how to run the various sizes and grades of pipe that are available.

The geologists have also been formulating a coring program. But when they turn this in, the manager of operations trims the daylights out of it because the costs involved are too high.

Consequently, as the well goes down, the cores which are taken don't give enough information to satisfy the core analysis expert, so he recommends that an electric log be taken. An electric log analysis expert is called in and for a short time everyone seems relatively satisfied with the operations.

This doesn't last long, however, because the next core analysis convinces the core analysis expert that the wrong kind of drilling mud is being used and that possible productive sands are being damaged. He recommends that the mud engineer be called in again.

The mud engineer fusses around with a pinch of this and a shovelful of that until he's worked out a new formula and they start drilling again.

Next time they run an electric log, however, they find that the new mud is not conducive to procuring normal electric logs. Furthermore, the sand analysis indicates that the well should be productive, but the electric log indicates the contrary.

Everything is halted once more and a gamma ray log is run. This fails to settle the argument, so they run a neutron log. The neutron log specialist's only contribution is to question the wisdom of ever drilling the well in the first place.

So after the roomful of specialists have argued back and forth for two or three days, someone makes the brilliant suggestion that they drill the well deeper. When this decision is passed on down to the tool-pusher, he gives his crew a four-letter-word lecture on the value of higher education and points out

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that he made this suggestion several days ago.

Shortly after this a good oil sand is encountered and everyone begins to say, "I told you so." But the reserves expert cools them all off by discovering the sand is only two feet thick.

The well is pushed on down and encounters hundreds and hundreds of feet of shale which finally turns to gray sand. Another conference of the experts is held.

The tool-pusher says the sand is wet. The electric log is negative. The sand analysis indicates possible gas production.

After listening to everyone's opinions, the vice president calls his wife. She consults her astrology charts and tells him to run the pipe.

By this time, however, the string isn't long enough to reach the bottom of the hole, so the purchasing agent has to get the president to call a friend of his in the steel business to put some pressure on a pipe outfit to get additional pipe.

The research experts inform the engineers that certain specifications regarding the slots for the liner should be followed. But by the time the pipe is procured there's no time for this and the well is gun-perforated.

The well won't flow, so the production engineer and the mechanical engineer go into another conference to decide what kind of artificial lift devices they ought to use. The process engineers design gas separation equipment, gas lines, and gas-treating facilities.

When all this is done and the equipment is installed, it is found that the company has enlisted the help of 35 different specialists on the project to get a well that will produce 35 barrels per day of 35-gravity crude.

This may be a slightly exaggerated account of what goes on around a modern oil company. We cannot operate and develop our modern industrial technologies without specialization. The further we develop our technologies the more specialized we have to become. So there's no going back to the old methods. However, that's no reason why we have to let this specialization make us completely lopsided as individuals. Specialized skills and knowledge should be developed as far as possible. But let's not get so engrossed in these techniques that they become the be-all and the end-all.

Our real task is providing power and heat and transportation and roads and friction-free machines for people. Only when you combine all the hundreds of special talents that go into the creation and distribution of petroleum products and then translate those products into terms of what they do for people, does our work mean anything. Once we get that perspective, we can all perform our particular specialties better. For we'll see our work in relation to the whole—to the over-all task that our industry is performing.

Relationship Between Purchasing and Operating

■ CONTINUED FROM PAGE 58

mit the specifications to several manufacturers in order to secure the item at the lowest possible cost.

Contributing to greater efficiency and economy is the need for close cooperation between both departments in the design of jobs. This is particularly true in times of equipment and materials shortages. Recognizing that it is not always possible for the purchasing department to procure the exact type and quantity of material required for a given job, the engineering or operating department should first determine the type of material in stock or immediately available and attempt to conform the job to the materials which may be most readily obtained on the market or in company stock. Frequent conferences between members of both departments should take place when new jobs are being contemplated and in most cases a satisfactory compromise can be achieved which will satisfy the engineering requirements of the job in hand. Such teamwork is essential in the company interest.

Closest Cooperation Necessary

Today, in view of the critical pipe shortage, the closest cooperation is essential between oil company purchasing and engineering departments in the matter of casing requirements. Because of such shortages, which are likely to prevail for some time to come, it is not always possible for a purchasing department to procure the exact type of casing specified by the engineering department for a particular program. Purchasers must take advantage of markets. When a mixed casing string is specified it is often necessary, in order to buy at the lowest level and still maintain the proper physical characteristics, to make substitutions from pipe actually in stock or more easily available. Seamless casing is furnished in three grades, H-40, J-55 and N-80. The cost of grade H-40 so closely approximates that of grade J-55 that the latter should be selected since it can be used in all wells regardless of depth, while the use of grade H-40 is limited; therefore, unless there is a definite requirement for the use of grade H-40 in a number of wells, a minimum of this type casing should be specified. This applies to H-40 and J-55 grade tubing and since the price of each is practically identical and following the same reasoning, only grade J-55 tubing should be specified.

It is only by constant contact between the two departments that cooperation and understanding can be achieved. Too many purchasing departments are jealous of their prerogatives and are inclined "to do the buying." Such an attitude works to the disadvantage of many departments, especially the engineering, and provides pitfalls which otherwise might be avoided by the purchasing department. It must be recognized that others beside purchasing have a responsibility in the selection of the proper material for the job at hand, and the placing of an order must not be considered so paramount as to endanger the over-all program. After all, the actual placing of an order is strictly a mechanical function, and it makes little difference who places an order. The important consideration is in placing the order properly, and an efficient purchasing department must control the purchasing to the best interests of the company, regardless of which department actually places the order.

When the above policy is followed it is customary to advise field personnel where to buy required material, with sufficient flexibility in the instructions to enable them to take advantage of special services offered by the supplier. At the same time, field personnel should be discouraged from promiscuous buying without regard of the standing or credit background of the seller.

Since engineers, operating superintendents and purchasing agents have wide contacts with sales people, the personal element not infrequently arises in the matter of placing orders. It is quite natural that an individual should wish to help a friend, and there is nothing untoward in such practice provided the friend is in position to offer goods and services on a competitive basis. However, purchasers must remember that they are spending not their own but their company's money and that such money must preferably be spent with the friends of the company rather than their own. In the company's interest, it is often necessary to place orders with companies or individuals that are disliked.

The personnel of the purchasing and engineering-operating departments should be sufficiently qualified so that each has full respect for the other's opinion, and these departments should be relatively on the same organizational level, so that problems requiring joint consideration can be mutually discussed on the same level.

A spirit of friendly cooperation should be maintained between these two very important sections of the company, so that their close cooperation will result in the greatest operating efficiency and economy.

Economics of Water-Flooding in North Texas

By WALTER C. KROG
Petroleum Engineer, Wichita Falls, Texas

UNLESS a water-flood project is economical to operate and can make money for the owner, it must be classed as a failure. Although a flood may be sufficiently successful from a technical standpoint to increase substantially the amount of oil recovered, it must be possible to realize profit from this oil if the project is to be considered successful from the economic or business standpoint.

Detailed study of two projects in North Texas indicates that small pools or sand lenses can be profitably flooded in North Texas. It must be recognized, however, that results at these projects do not provide a rule of thumb for estimating costs or profits from other projects, but only point to the possibilities of other profitable operations. Size of the reservoir, depth, well conditions, available water supply, and many other determining factors enter into costs and profits and must be given due consideration in deciding whether to install a flood.

Before any water flood is attempted, a complete survey should be made by competent engineers who are familiar with the technique, and the survey should give reasonable assurance of increased recovery and profit from a flood.

THE literature provides interesting information dealing with water-flood projects in North Texas, mainly concerned with such engineering factors as preliminary work necessary before initiating a flood, sand characteristics, water injection problems, and other important points which engineers should consider in this type of secondary recovery work. But one factor which seems to have been overlooked is the economics factor. The technology involved in setting up and operating a flood is most essential, but unless the flood is economical to operate and can make money for the owner, it must be classed as a failure. It is, of course, interesting from a technical standpoint to see successful results from a flood with an appreciable increase in the oil produced, but the fact remains that although 1 million additional barrels are produced, and no profit is realized from this oil, it cannot be termed successful.

Questionnaires Sent

Lack of economic data prompted the North Texas Oil and Gas Association to assemble information covering profit and loss statements pertaining to water-flood operations in that area and questionnaires were sent to producers operating water floods in North Texas. Results obtained proved of considerable interest and form the basis for this paper. Data were made available by Arkansas Fuel Oil Company, Bridwell Oil Company, Cable Oil Company, Fresno Oil Company, Humble Oil & Refining Company, and Kenrow Company. The U. S. Bureau of Mines also cooperated in the project and furnished some important statistics.

Of the six projects on which information was furnished, two had not been operated a sufficient length of time to provide conclusive data. Two others may more properly be classed as water disposal projects, thus leaving but two of the six projects reported to be considered as representative flood projects. These have been in operation for a number of years and apparently have been successful. They may not be called the most successful floods, but with regard to size and amount of oil recovered they represent an average for this type of operation and reflect results which might reasonably be expected elsewhere in North Texas under similar operating conditions. It also must be understood that figures given herein cannot be used as a "rule of thumb" in estimating costs or profits from a proposed project, as it must be realized that size, depth, well conditions, available water supply and many other determining factors enter into costs and profits. The figures are primarily intended to show that small pools or sand lenses can be flooded profitably in North Texas.

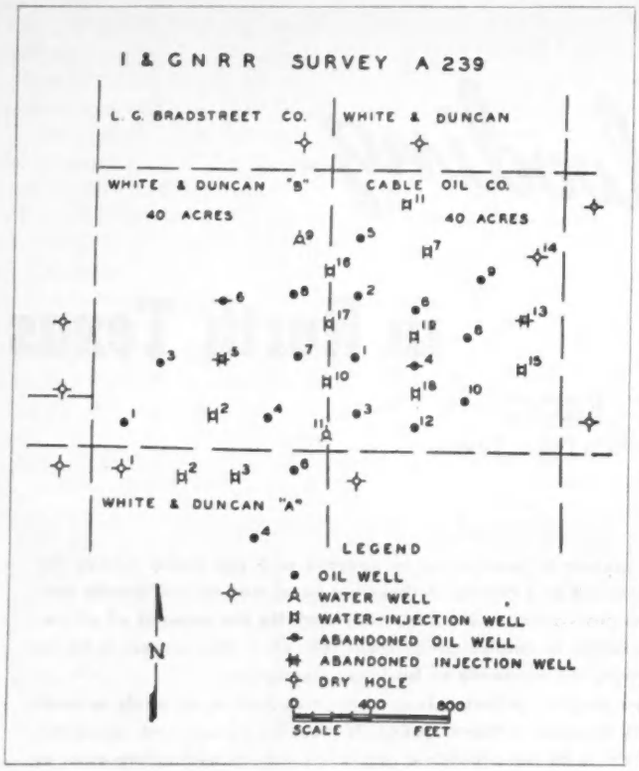
The two projects under discussion are Cable Oil Company's Webb project, I. & G. N. R. R Survey Abs. 239, in the extreme southeast corner of Archer County, and Fresno Oil Company's Prideaux project, Block 20, A. McMullen Survey, Abs. 286, and the A. Rohus Survey, Abs. 240, Archer County, about five miles north of Markley.

Profit and loss statements by years were compiled on the two projects from the start of flooding operations to the latter part of 1947, after which an attempt was made to convert the figures to a current status by using a yardstick which it is believed reflects increases in labor, drilling and material costs against the present price of crude.

In the Cable-Webb project, the flooded sand is found at an average depth of about 685 feet with an average thickness of 12 feet, average porosity of 25 percent, and average permeability between 500 and 600 millidarcys. Details of these floods are completely covered in a Bureau of Mines report (History of Water-Flooding of Oil Sands in North Texas, by Peter Grandone, D. A. Jessup and D. B. Taliaferro).

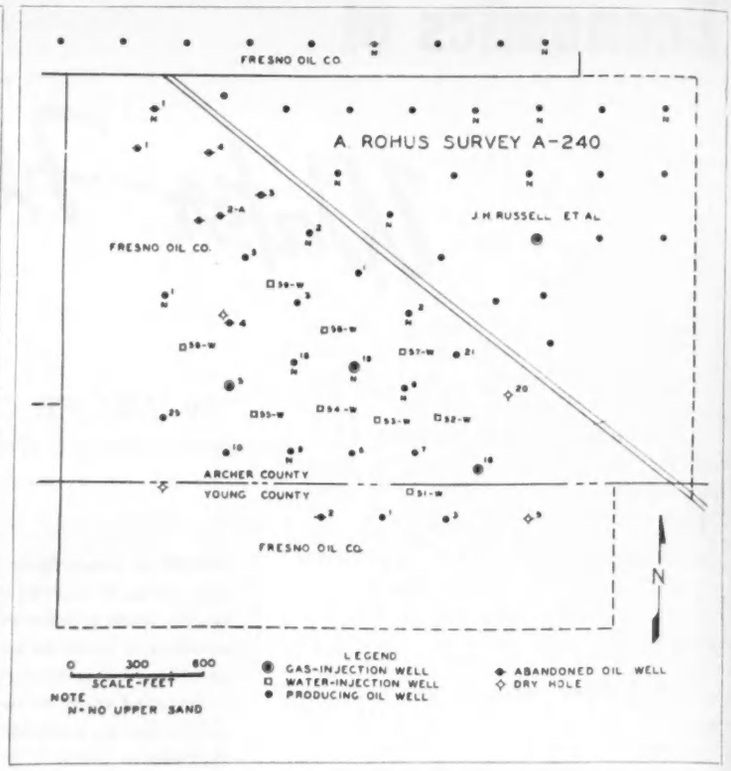
Webb Flood Begun

The Webb flood was started in October, 1940, and up to the latter part of 1947 there had been approximately 59,000 barrels of oil recovered over and above what might have been produced under primary production methods. At the beginning of the flood the lease was making about 29 barrels daily; at the end of 1941 daily production had increased to 75 barrels, and peak production of about 102 barrels daily was reached in 1942. Four injection wells were drilled and equipped at a cost of $3360; engineering fees for preliminary and supervisory work were $1200; plant



Cable Oil Company's Webb Water-Flooding project, Archer County, Texas.

—Courtesy U. S. Bureau of Mines



Fresno Oil Company's Prideaux water-flooding project, Archer County, Texas, about five miles north of Markley.

—Courtesy U. S. Bureau of Mines

installation of a used engine and used water pump, $650; filters and charging materials, $225; water tanks and meters, $2070; two water wells and equipment, $1610; lines and connections, $1100; or a total investment of $10,215. Operating expenses increased approximately 75 percent. The average price of oil for the entire period covered was $1.28 per barrel. The total income from the seven-eighth interest for the period was $94,977; and operating expenses during that time totaled $49,823, which include ad valorem taxes and supervision. Deducting the cost of the plant ($10,215), the operation showed a net profit of $34,939.

The properties had practically reached their economic limits and in the absence of additional production would have been abandoned. It is therefore reasonable to assume, because of an appreciable increase in revenue and profits due to an increase in production from flooding and the continued operation of the lease, that for all practical purposes all oil produced after the flood was started should be credited to it; certainly it was oil which otherwise would never have been recovered. Incidentally, this project has again reached its economic limit and will no doubt be abandoned in the near future unless more advanced techniques in water flooding are found and applied.

In order to determine what effect present costs and prices might have on the project, assume that the flood was started and carried on under present prices and operating conditions. In this hypothesis let it be assumed that labor and operating costs have increased 50 percent. (Since some of the actual costs used are for 1946 and 1947 and therefore reflect the increases, the writer feels that this figure is more than adequate.) Plant equipment and other costs are presumed to have increased 60 to 100 percent, while oil prices have increased to a current $2.65 per barrel. This, then, results in a different picture. Preliminary work and plant cost would increase from $10,215 to $18,518; operating expenses for the period from $49,823 to $74,735; income from oil sales from $94,977 to $196,676; leaving a net profit of $103,423, or an increase of almost 200 percent.

Fresno Oil Company's Prideaux water flood was started in June, 1943, at which time daily production on the property was about 20 barrels. By the end of that year production had increased to 25 barrels and continued to increase to a peak of 69 barrels daily in 1945 with an average of about 30 barrels per day in 1947. The formation flooded in this project is the Swastika sand found at an average depth of 660 feet with an average thickness of 11½ feet. Available core analysis

About the Author

WALTER C. KROG graduated from Wisconsin School of Mines, served overseas in World War I, and joined American Zinc Company as engineer at Mascott, Tenn. In 1921 he went to New York City with Darnell and Eaton, consulting engineers. He entered the oil and gas business in 1929 as an engineer with Duquesne Gas Corporation in Pennsylvania and West Virginia. In 1933 he moved to Wichita Falls, Texas, as petroleum engineer with King Oil Company. He resigned in 1941 to become associated with W. H. Hammon of Wichita Falls, as an independent oil producer. He was chairman of the first engineering committee which organized and started the KMA Pressure Maintenance Association. He is past chairman of the North Texas Chapter, API; past president of North Central Texas Chapter of the Texas Society of Professional Engineers, and at present is chairman of the Secondary Recovery Committee of the North Texas Oil and Gas Association.

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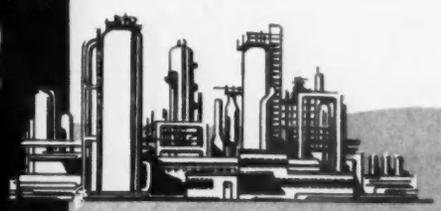

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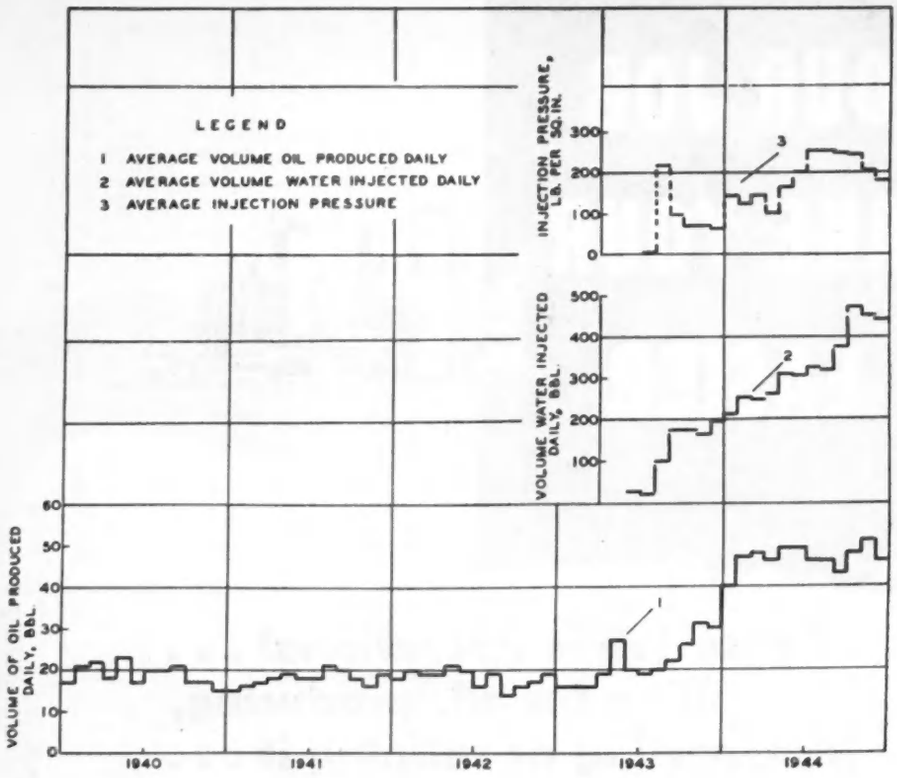


Production history of Fresno Oil Company's Prideaux water-flooding project

—Courtesy U. S. Bureau of Mines

data show the average porosity to be 23 percent with a permeability ranging from 200 to 600 millidarcys. This lease also had been repressured with gas prior to water flooding. From the inception of the flood up until June 30, 1947, there had been recovered approximately 40,000 barrels of oil over and above that which might otherwise have been produced, and since this lease is still operating profitably, it will undoubtedly be continued in operation for some time.

Cost of engineering services, key wells drilled and plant equipment for this project totaled $17,108; operating expenses increase from a yearly average, prior to water flooding, of $3000 to an average of approximately $8000 after flooding started. Price of oil for the period averaged $1.49 per barrel. Total revenue from oil sales for the period, June, 1943, to June 30, 1947, was $93,429; total expenses, $41,143; cost of plant and equipment and preliminary work, $17,108, leaving a net profit on the project of $35,178.

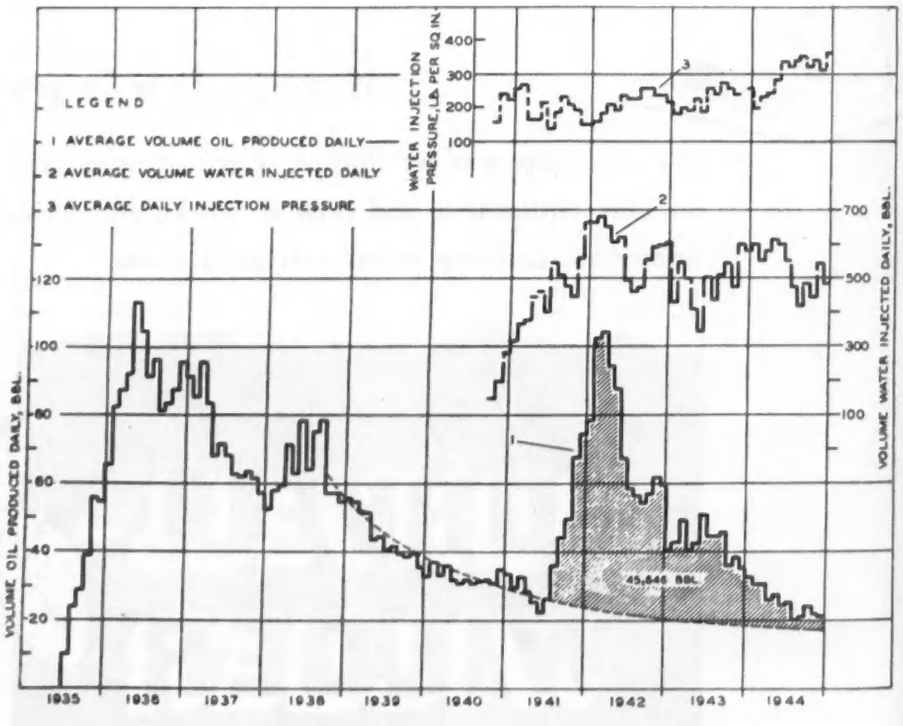
Again assuming the project to have been started and carried on under present prices and conditions, a total revenue of $166,319 is arrived at; cost of plant $30,553; total expenses, $61,714; leaving a net profit of $74,052, or more than 100 percent increase.

A further comparison of figures shows that in both projects the flush production was obtained during the first three years after the flood was started; and that increased revenue was more than sufficient to pay all operating costs and to return the original plant investment within the first two years of operation. With present prices and conditions these costs could have been amortized in 18 months.

However, it is not intended to give the impression that water-flooding will be successful whenever and wherever it may be tried or that it is a simple and inexpensive method of operating, and it must be pointetd out that there have been projects in this area upon which large sums have been invested with no appreciable results.

It is equally true, however, based on studies of many projects which have failed, that such failures were primarily due to lack of good engineering or adequate preparation. Before any water flood is attempted, a complete survey should be made by competent engineers who are familiar with the technique. This survey should completely cover all past lease history as to oil and water production and expense records; any previous attempts at secondary recovery, such as gas repressuring; drilling and well completion methods; geology, including complete data on the sand from core analysis and electric logs if available; reservoir conditions; water supply available and complete analysis of the water. The survey should also include a planned program as to development for either production or injection wells, treatment of water, rate of water injection and the regular and complete supervision of the flood with complete records being kept at all times.

If after such a preliminary survey is made and results indicate a reasonable assurance of increased recovery and profit from a water flood, it is reasonable to expect that, with the present favorable price of crude, such an operation can be carried on profitably.



Production history of Cable Oil Company's Webb water-flooding project

—Courtesy U. S. Bureau of Mines

Discover Oil Directly?

Part 1. THEORETICAL DEPTH-RESISTIVITY CURVES

By HUBERT GUYOD
Consultant, Houston

SINCE geophysics was first applied to the search for oil a few decades ago, it has been thought that one of the best possibilities for finding directly petroleum accumulations is in the field of electrical prospecting. Offhand, oil and gas reservoirs appear to be a rather easy target because their resistivity is generally much greater than that of the associated formations. Unfortunately, the method has met with little, if any, success as yet notwithstanding numerous attempts made under a great variety of conditions.

The reasons for this failure are not generally understood. In fact, because electrical methods are only little used in this country for oil exploration, their possibilities and limitations are not as properly evaluated as those of other geophysical methods. It has therefore been thought desirable to review briefly some of the principles involved in the resistivity method and to analyze them with a view to determining whether the method can really be used successfully to discover directly oil or gas fields.

Principle of Resistivity Method

There are two main methods in resistivity exploration:

the horizontal (or mapping) method,
the vertical (or sounding) method.

The first consists in making, over the area under investigation, resistivity measurements involving essentially a constant thickness of sediments, while the second one consists in measuring, at a number of stations, the resistivity of a thicker and thicker volume of sediments. Obviously, the resolving power of the vertical method is greater than that of the horizontal method. Therefore only the vertical method will be considered in this paper.

The electrode separations required by the vertical methods are relatively large. Therefore only direct-current can generally be used for the measurements in order to avoid the skin-effect.

Problem Involved

In their most simplified form the conditions to be dealt with are represented in Figure 1. Basically, the problem consists in locating a relatively thin bed B of uniform resistivity R and uniform thickness T situated, between depths D_o, and D, within a uniform formation F of resistivity R_o, a shale for example. Bed B is assumed to be horizontal and of infinite lateral extent, and the ground surface is supposed to be flat and horizontal.

A great number of different electrode arrangements can be used in resistivity exploration. The data discussed in this article are based on calculations made for the well-known Wenner arrangement, but the conclusions which will be reached can nevertheless be applied to

TABLE 1

Theoretical minimum resistivity contrast of a petroleum reservoir to stand chance of discovery by the vertical resistivity method, as a function of depth and thickness.

Reservoir Thickness...	5′	10′	20′	30′	50′
Reservoir Depth					
1,000	40	20	10	6.7	4
2,000	80	40	20	13.3	8
3,000	120	60	30	20	12
5,000	200	100	50	33.5	20
7,000	280	140	70	47	28
10,000	400	200	100	67	40

NOTE: Length unit arbitrary, but same unit must be used for depths and thicknesses.

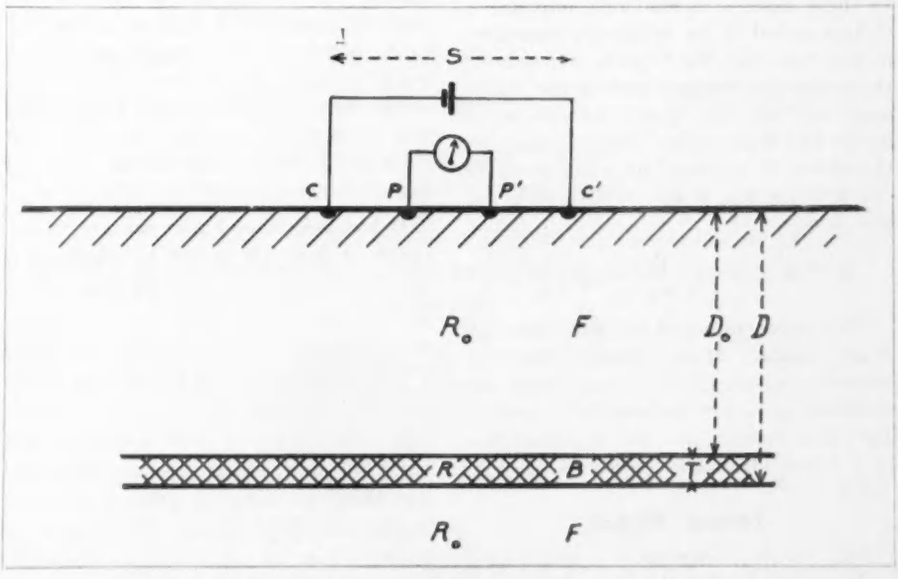


FIGURE 1. Illustration of Wenner electrode arrangement in oil exploration.

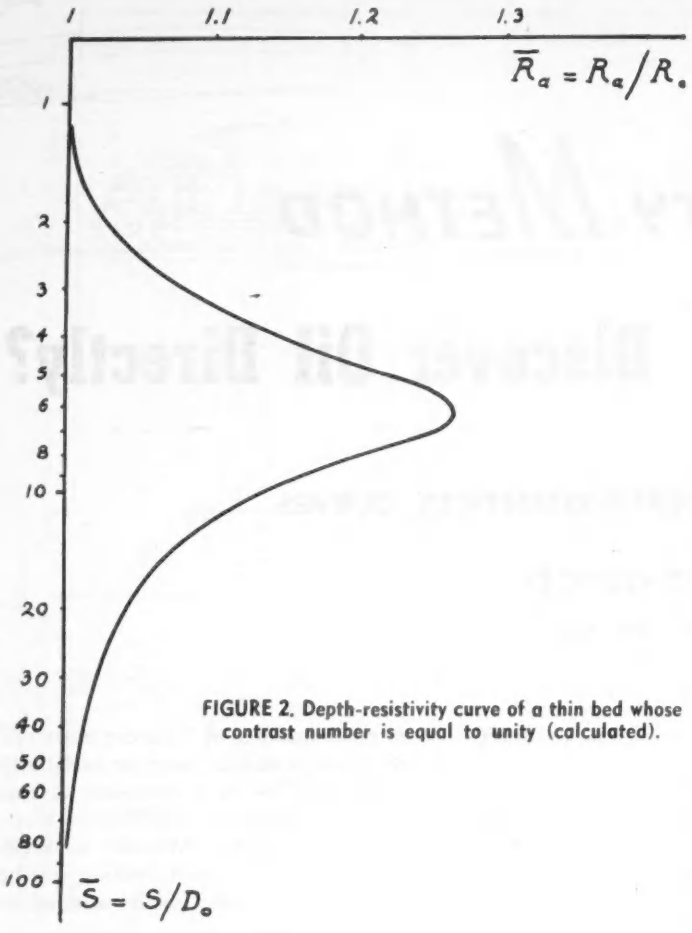


FIGURE 2. Depth-resistivity curve of a thin bed whose contrast number is equal to unity (calculated).

almost any other conventional electrode configuration, at least qualitatively.

Contrast Number

We can define the resistivity contrast $\overline{R}$ as being the ratio $\frac{R - R_o}{R_o}$, and the thickness contrast $\overline{T}$ as the ratio $\frac{D - D_o}{D_o}$

If the resistivity of bed B is equal to the resistivity of formation F, $\overline{R}$ is nil. Also if bed B is infinitely thin, $\overline{T}$ is nil. In these cases it is evidently impossible to locate bed B by resistivity measurements. On the other hand, the greater the resistivity contrast and/or the thickness contrast, the easier it will be to locate bed B, all other factors remaining the same. It is therefore convenient to characterize bed B by the following expression:

$$K = \overline{R} \times \overline{T} = \left(\frac{R}{R_o} - 1\right)\frac{T}{D_o} \qquad (1)$$

This expression will be called the contrast number. It is obvious that this number measures, to a certain extent, the resolving power of the resistivity method for discovering an oil accumulation under the idealized conditions of Figure 1.

Vertical Method

The vertical method consists essentially in taking, at each station, a number of measurements with increasing electrode separation, whereby the apparent resistivity is obtained on an increasing thickness of sediments.

By virtue of the homology principle, absolute values need not be considered in the theory of the resistivity method. Therefore, precalculated data can be plotted as apparent resistivity contrast $\overline{R}_a = R_a/R_o$ vs. relative spacing $\overline{S} = S/D_o$ R_a denoting the apparent resistivity, and S the current electrode separation CC' (See Figure 1). These plots are called depth-resistivity curves.

To illustrate the following discussion, assume that bed B is an oil sand 100 times as resistant as the surrounding shale F. Also suppose that the oil sand is 30 feet thick and 3000 feet deep, or more generally that its thickness is equal to one-hundredth of its depth. The contrast number for the foregoing conditions is therefore equal to unity.

Calculations show that the corresponding depth-resistivity curve is essentially as shown by Figure 2. Although the resistivity contrast is relatively high, namely 100, the maximum apparent resistivity observed is only equal to 1.27 times the apparent resistivity which would be measured if the oil sand were not present within the shale formations; this is due to the fact that the bed thickness is very small compared to its depth.

It has been found that the very same curve (Figure 2) would be obtained if the bed thickness were doubled while, at the same time, the bed resistivity were halved. More generally, the same curve would be obtained if the bed thickness and the bed resistivity were simultaneously altered in such a manner that the contrast number remains constant and equal to unity. In other words, the depth-resistivity curve of Figure 2 characterizes all thin beds whose contrast number K is equal to unity.

A similar remark can be made for any other value of the contrast number provided $\overline{R}$ is not too small and $\overline{T}$ not too great, which is the case for most petroleum reservoirs. This means that the depth-resistivity curve of a petroleum reservoir is dependent upon the contrast number only. Figure 3 represents depth-resistivity curves for five different contrast numbers. All these curves have the same shape; in particular all exhibit a hump, the ordinate of which increases when the contrast number increases. On the other hand, the hump abscissa has nearly the same value, 6, for all the curves.

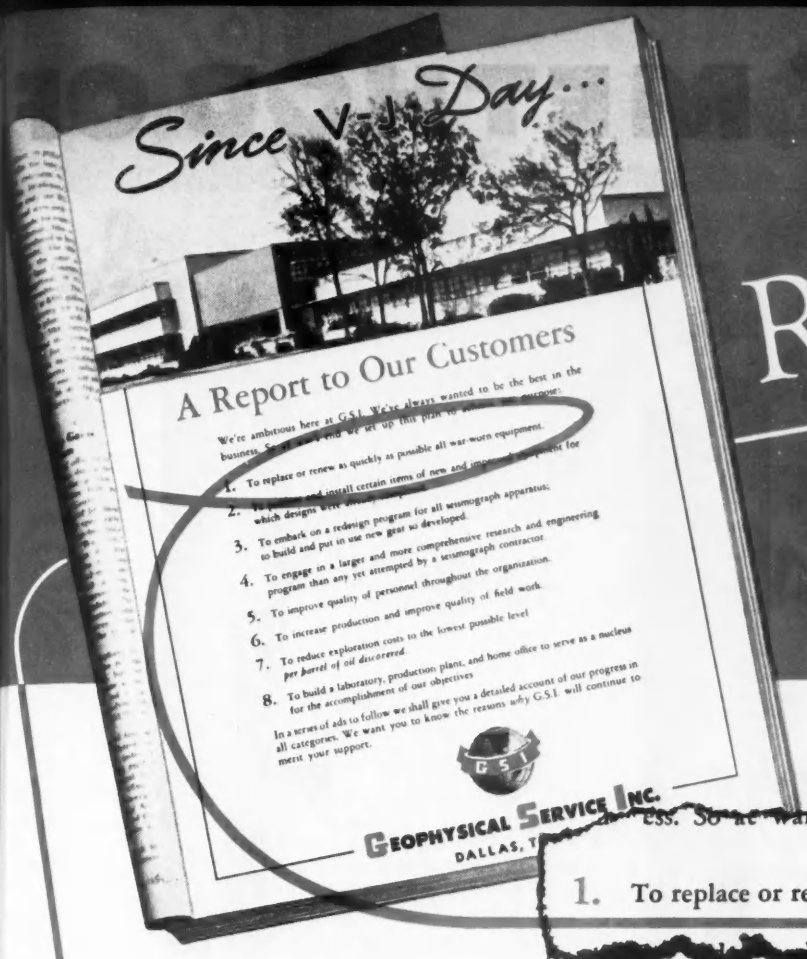
From Figure 3 (page 74) it is possible to draw many interesting conclusions regarding the applicability of the vertical resistivity method to the direct discovery of petroleum accumulations.

Limit of Applicability

Suppose that the field measurements (voltage, intensity, lengths) are made with such precision that the over-all errors in an experimental depth-resistivity curve are 10 percent or less. While the over-all accuracy is certainly greater than 10 percent for short electrode separations, it is probably close to this figure for long separations because of the difficulty of making low voltage measurements in the ground when direct current is used. Anyway, the conclusions reached by this paper are not dependent upon the accuracy of the measurements, and the foregoing figure can therefore be used to illustrate the following discussion, regardless of the accuracy attained.

Figure 3 (page 74) shows that when the accuracy is 10 percent, only beds for which the hump ordinate is greater than about 1.10 can be discovered. This corresponds to beds whose contrast number is greater than 0.2. For example, an oil sand which is 30 feet thick and situated at 3000 feet cannot be located by the vertical method if its resistivity is less than 20 times the resistivity of the shale bed in which it is situated. More generally, a necessary condition for discovering a petroleum reservoir with the vertical resistivity method is that the restivity contrast $\frac{R - R_o}{R_o}$ of the reservoir be at least equal to the numbers given by Table 1.

Inasmuch as resistivity contrasts greater than 20 are frequent, the table shows that, in theory, the method could be successfully used for discovering many oil or gas pools. Unfortunately this is not so in practice because many other factors which have been disregarded above should be considered to evaluate properly the method. The influence of these factors will be discussed in the concluding article next month.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BROWN METHOD OF

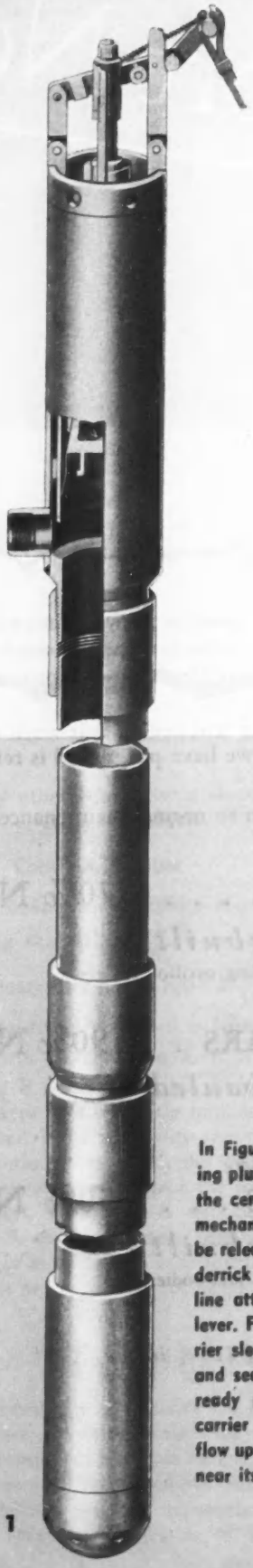

Fig. 1

In Figure 1, left, the cementing plug is shown supported in the cementhead with tripping mechanism set and ready to be released instantly from the derrick floor by a pull on the line attached to the tripping lever. Fig. 2, center. The carrier sleeve has been released and seated. The plug has already started its drop. The carrier sleeve forces mud to flow upward and through ports near its top to the top of cementing plug. In Figure 3, right, the carrier sleeve has been moved up and tripping mechanism re-set by pressure inside the casing. The cementing plug is in position on the latching collar with hold-down slips gripping the casing. At this point pressure on the casing can be relieved, leaving it in a STRESS-FREE CONDITION WHILE CEMENT IS SETTING.

Fig. 2

Fig. 3

CEMENTING CASING

offers many major advancements that make it the surest cementing operation ever developed

Conventional casing cementing methods are beset by numerous operational limitations which make it impossible to obtain a satisfactory cementing job in many wells.

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How is this accomplished?

1. New Type Cementing Head

This head, which carries the casing plug, can be operated INSTANTLY from the derrick floor, WITHOUT STOPPING THE PUMPS, to change valve arrangements or release the plug. This eliminates the risk of losing circulation while cement is being run.

The carrier sleeve which supports the plug allows flow-line pressure in the head to equalize on both ends of the plug and relieves the tripping mechanism of unbalanced forces. When proper volume of cement has been pumped into the casing, the carrier sleeve is released, WITHOUT STOPPING THE PUMPS, and forced downward against its seat. Full pressure of the pumps is then directed to the top of the plug.

Simultaneously, the means supporting the plug are released so it falls with the top of the cement column. After the plug is released, the tripping mechanism is also released, so that any increased pressure in the casing string will cause the carrier sleeve to move upward, giving a positive indication that the plug is being pumped to bottom. If the carrier sleeve does not move upward (indicated by tripping mechanism outside the head) it indicates a vacuum in the casing.

2. New Type Plug

This new casing plug, equipped with hold-down slips, provides a back pressure seal whenever and wherever it is needed, thereby eliminating the necessity of maintaining pressure on the casing string after the plug has stopped. The plug stops on a landing collar placed in the casing string at the desired distance off bottom. The hold-down slips make it impossible for the plug to be forced upward when downward pressure of mud becomes less than upward pressure of the cement column. All parts of the plug are made of drillable material.

3. Float-N-Fill Shoe

The Float-N-Fill shoe permits the pipe to fill up from the bottom as it is being run in the hole. This process of alternately floating and filling the pipe effects a tremendous saving in man hours and dollars on every cementing job. In addition it partially relieves the pressure built up ahead of the casing string as it is lowered in the hole . . . it permits the pipe being kept in almost constant motion, thereby minimizing the danger of stuck casing. This is particularly advantageous in directional holes.

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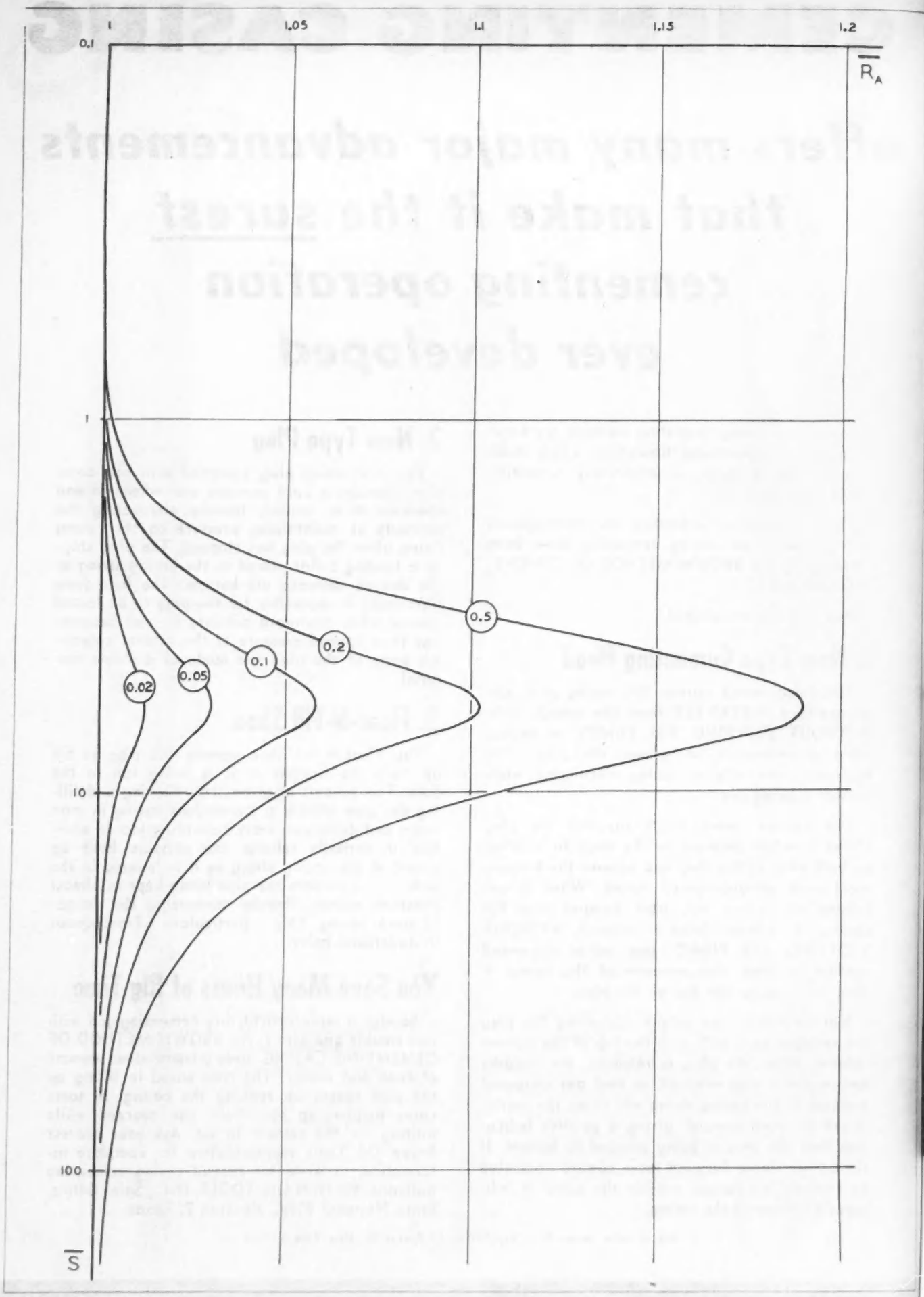
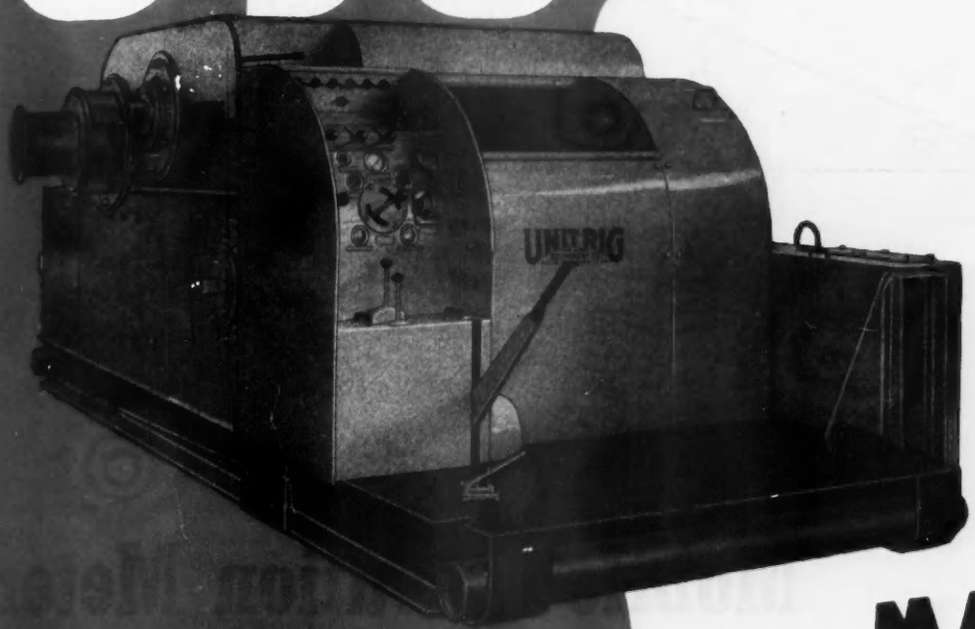


FIGURE 3. Typical depth resistivity curves for thin resistant beds. Numbers in circles denote contrast numbers (calculated).

U-30



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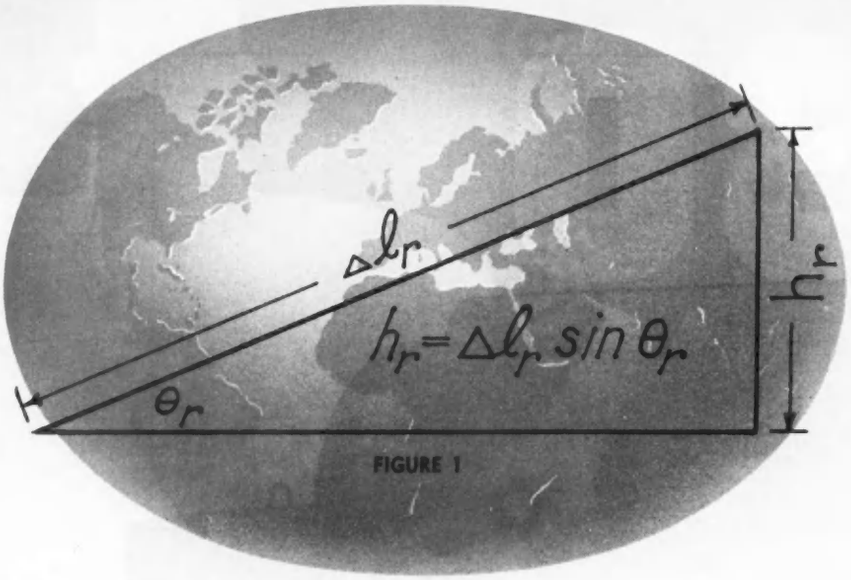


FIGURE 1

Sun Oil Company's Mobile Elevation Meter

By J. E. KASTROP
Staff Writer

DETERMINING THE elevation, or height above sea level, of shot points or gravity meter stations, as well as surface geology control points, is of considerable importance in mapping subsurface structures. Just as radar has aided the location of shot points in open waters, a recent development of Sun Oil Company's Research department will speed elevation measurements in land exploration programs. The elevation meter holds promise of minimizing time-consuming spirit level surveying now a necessary part of any geophysical or geological program.

ELEVATION surveys have been speeded up considerably by a postwar mobile elevation meter invented and developed in Sun Oil Company's Physical Laboratory at Newtown Square, Penn. Co-inventors are Ford L. Johnson, the laboratory manager, and Fred M. Mayes, research physicist.

The elevation meter measures the difference in elevation between points on the earth's surface with an accuracy of a fraction of a foot in several miles. Experience has shown that under favorable conditions, 80 miles can be covered in an operating day, compared with about eight miles that can be surveyed by a spirit level ground crew under similar conditions of average terrain.

First disclosure of an earlier model of the elevation meter was made in June, 1948, at the American Congress of Surveying and Mapping in Washington, D. C. Since that time, however, modifications have been made, and thousands of miles of actual survey work have been completed. Among the first jobs performed by the elevation meter was to provide vertical control for aerial surveys in topographic mapping. A more recent operation has been that of establishing elevations for station sites for geological and geophysical exploration.

While its application extends to many fields where there is a need for elevation control, the mobile elevation meter is limited in use only by the fact that it can traverse distances which can be covered by the towing vehicle, which for the present is a passenger automobile. Elevations of shot points or gravity meter stations or other points off the path of the elevation meter course must be made by the surveying party. However, these selected elevation stations, made by the mobile elevation meter as near to the actual location as possible, have saved much time-consuming elevation work.

Principle of Operation

Fundamental principle of operation on which the elevation meter is based is a trigonometric function of the right-angled triangle shown in Figure 1. If h_r is the difference in elevation between two points, and the angle of inclination, Θ, as well as the linear distance Δl_r are known, then:

(1) $h_r = \Delta\ l_r \sin \Theta_r$

The elevation meter, in effect, performs the above computation 500 times during every foot of travel over the surface, adding the increments of height (h) cumulatively as the survey proceeds upward above any given starting elevation. If, at any point along the survey, the inclination is downward, the increments of (h) are negative, and are subtracted from the positive readings.

A mathematical explanation may be made by referring to Figure 2. If the contour line between points A and B represents the cross section of a roadbed over which the elevation meter travels, and if the elevation above sea level at A is known, then the elevation at B can be determined by measuring H and adding this height to the elevation at point A. If the contour sloped

downward from point A, then the difference in elevation H, would be subtracted from the elevation at point A to obtain the elevation at B.

The difference in elevation between points A and B may be expressed as the sum of the increment lengths, Δl, multiplied by the sine of the angles of inclination measured over the distance Δl.

Expressed mathematically, the difference in elevation, H becomes:

$$(2) \quad H = \Sigma \Delta l \sin \theta_r$$

Since Δl is a function of velocity and time, it may be expressed as:

$$(3) \quad \Delta l = v \Delta t$$

Then the difference in elevation between points A and B becomes:

$$(4) \quad H = \Sigma v \sin \theta \Delta t$$

When the time interval over Δl is small, that is, Δt approaches zero, the difference in elevation can be expressed as:

$$(5) \quad H = \int_A^B v \sin dt$$

When traveling at 20 miles per hour, the elevation meter actually makes 14,667 computations per second. Thus it can be seen that the time interval for each computation is quite small.

Heart of the elevation meter is a pendulum mechanism mounted on the three wheeled, triangular-shaped trailer of special design. This element of the meter furnishes an output signal which is proportional to the angle of inclination. It is responsive only to changes in longitudinal inclination and is insensitive to changes in transverse inclination. Output of the velocity generator is proportional to the unit's speed. This velocity signal is transmitted to the towing vehicle through an electrical cable.

Component Parts

Figure 3 shows an outline drawing of the component parts of the elevation meter. The pendulum and the velocity generator are mounted on the trailer. A flexible cable drive geared to the rear trailer wheel powers a mechanical counter which records the distance traveled over the earth's surface. The velocity generator, in turn, puts out a signal which is proportional to the velocity.

These two signals (one from the pendulum, the other from the velocity generator) are transmitted separately to the towing vehicle through two independent electrical cables. Inside the towing vehicle is mounted the electronic integrator which receives the two signals and integrates them according to formula (5). Results of the integration or elevations are shown on a relay-operated mechanical counter placed adjacent to the electronic integrator. The counter is constructed to indicate changes of one foot. Tenths of feet are indicated on an auxiliary electrical meter. The mechanical counter also indicates the distance traveled in feet. This is also a relay-operated counter and is calibrated in feet, while an electric meter indicates tenths of feet.

Power for all circuits employed by the elevation meter is provided by a Leece-Neville system, driven by the towing vehicle engine. The power supply which furnishes electric current at the proper frequency, voltage and ampere values is located in the trunk of the towing automobile, as shown in Figure 4.

Special Trailer Construction

While of peculiar appearance to some, the three-wheeled trailer employed is of

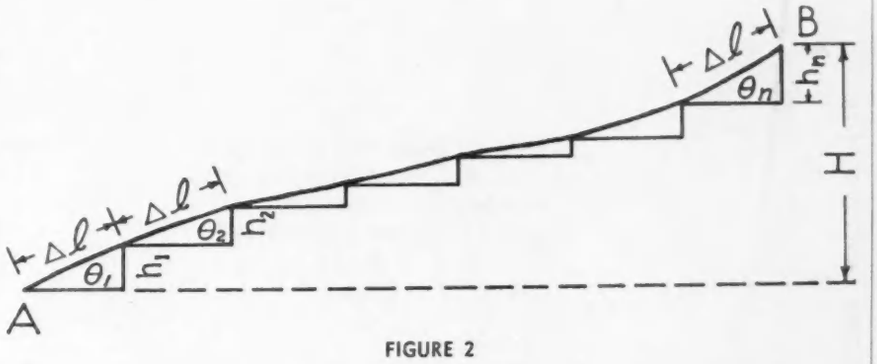


FIGURE 2

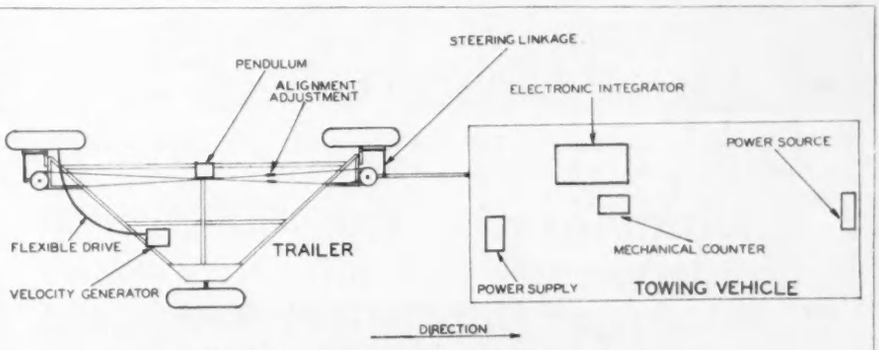


FIGURE 3. Component parts of the elevation meter.

FIGURE 4. Power supply which furnishes the various circuits with required voltages, current, frequency, is mounted in the towing vehicle's trunk.

special design and involves a study of trailer geometry. The outline drawing showing the arrangement of component parts illustrates the configuration of the trailer, while the photographs show some of the construction details. The front and rear wheels are mounted on stub axles so they can be pivoted about the king pin. The third wheel, located at the apex of the triangular frame, is permanently fixed so that its axis of rotation is perpendicular to the center line between the pivot point of the front and rear wheels. The third wheel is also equidistant from front and rear wheels. The front and rear wheels are interconnected by steering cables, and therefore turn together, but in opposite directions. Distance between the front and rear wheels is approximately eight feet, with the pendulum located half way between the two wheels. From a theoretical point of view, it would be preferable to make this base length as small as possible. Mechanical considerations brought about a compromise which does not cause any significant errors at the present level of precision.

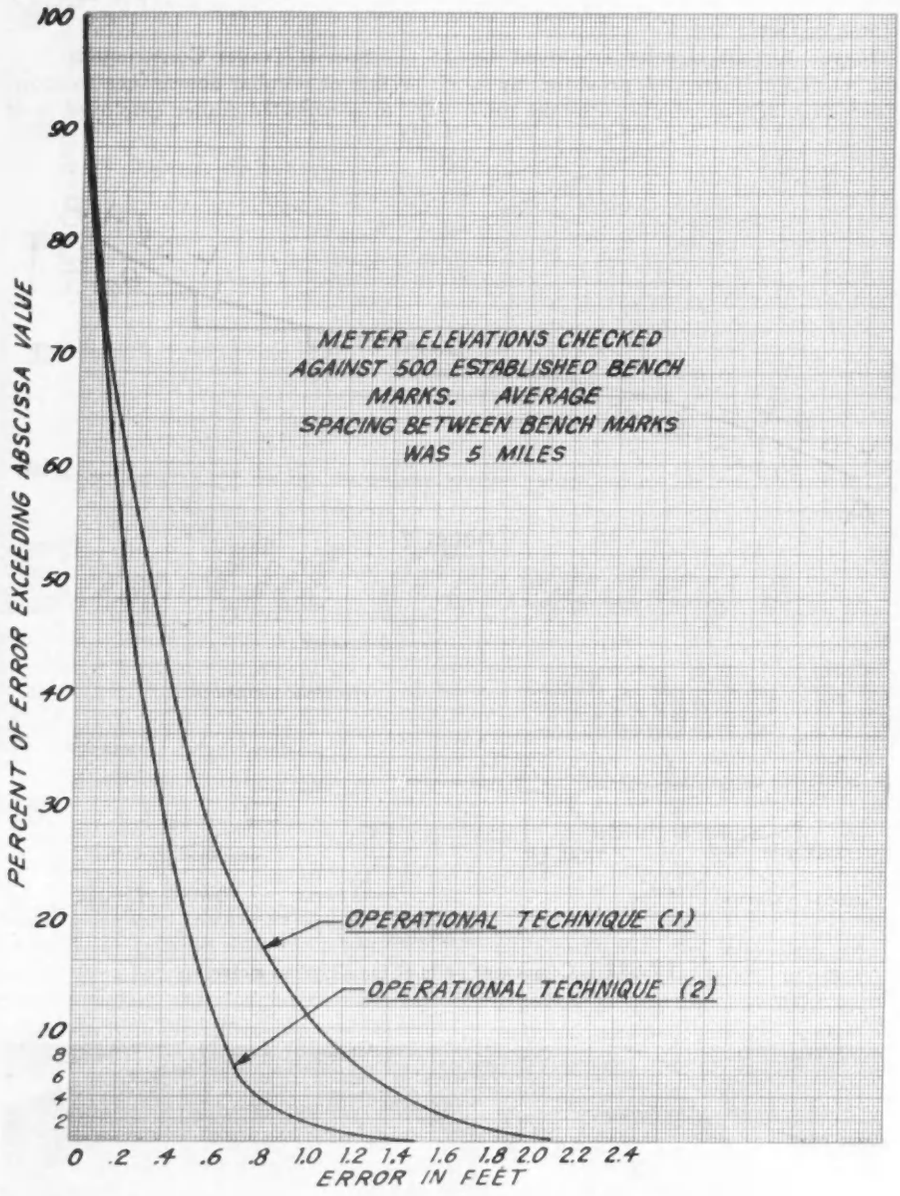
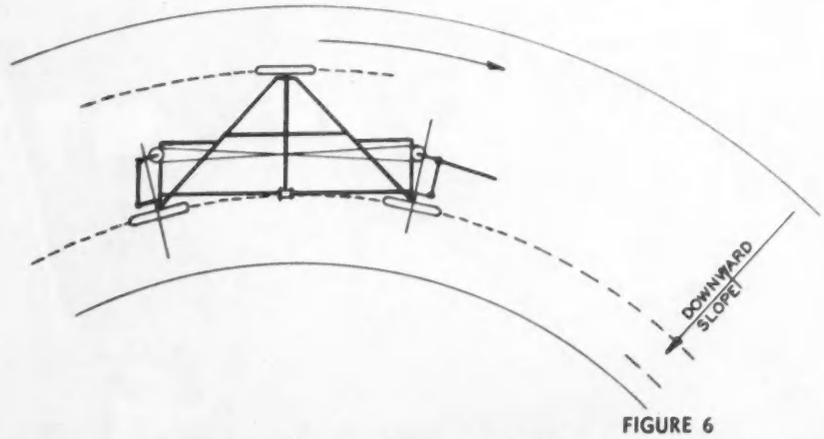


FIGURE 5. Error distribution curves.

Pendulum Motion

Motion of the pendulum at this midpoint is always at right angles to the turning radius of the trailer, and therefore the instantaneous direction of the trailer is in the plane of the pendulum's motion. The three-point support insures that the front and rear wheels will always be in contact with the road. On smooth road surfaces, a speed of 25 miles per hour can be attained with ease, but over irregular surfaces, speed must be reduced to minimize bouncing of the trailer. In Figure 6 it will be noted that the rear wheel exactly tracks the front wheel, placing the pendulum at the tangent point on an arc of the turn. The pendulum must have its plane of motion parallel to the direction of tow to avoid errors due to transverse slope. The proper azimuth orientation for the pendulum is determined empirically by raising and lowering the third wheel and turning the pendulum until no effect is noted.

Included in the trailer construction



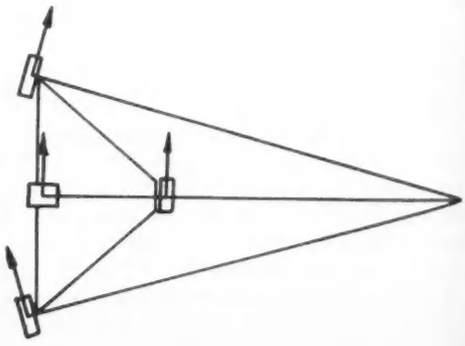


FIGURE 6

Left: In making turns, the pendulum follows a path which tracks the front and rear wheels over which terrain the elevation measurements are made.

Right: Geometry of the trailer is such that the pendulum's motion is always parallel to the direction of the trailer. In turns, the pendulum's motion is at right angles to the turning radius.

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is a tubular container used to transport the surveyor's rod. A perpendicular member of angle iron is mounted as near the pendulum as practical. Knowing the exact distance from the top of the rod to the road bed, elevation measurements can be transferred from the trailer to some point away from the road. Known benchmarks along the road are also checked in this manner to determine any error that might have accumulated in the meter.

A trailer guiding lever was found helpful, particularly when backing the unit. The guide tongue is connected to the tie rod on the front wheel and controls both wheels through the steering cables. It is locked in operating position parallel to the trailer tongue. Direction of wheel travel is then controlled by the towing vehicle and the trailer tongue. When backing, one operator unlocks the guiding lever from the tongue, and controls the direction of wheel travel independently of the trailer tongue.

Calibrating the Meter

To calibrate the meter, the pendulum is placed on a tilt stand and adjusted to an angle of 15 degrees plus and then 15 degrees minus. While in these respective positions, a standard velocity signal is supplied to the integrator. A short run of about one minute is made and if the answer is incorrect, an adjustment is made. Since the integrator is of an electronic type, it is necessary that a standard voltage for reference be provided. The electromotive force of a standard cell is compared continuously with a reference voltage in the system. The circuit is so designed that an automatic correction is made, should the latter voltage vary. Thus, the standard cell becomes the final standard of measurement for the entire system.

More Precise

A calibration may also be made by running the meter between two points of known elevations. Experience has shown that the static calibration is a more precise method since small road errors may contribute to an uncertainty in the latter method.

A check of the system performance can be made during field operations. The mechanical counter is geared directly to the velocity wheel and thus the distance is recorded on the trailer. The electrical velocity signal is transmitted to the towing vehicle and to the electronic integrator, where the distance is again indicated. The two distances shown must agree quite closely. If they do not agree, it is positive proof of error in the performance of the system. Experience has shown that the integrator is extremely reliable.

Accuracy and Operating Techniques

The accuracy which may be realized in the field operations is illustrated in Figure 5, which gives error distribution curves for two operational techniques. These curves were obtained by comparing the difference between elevation meter elevations and 500 bench marks, which were spaced an average of five miles apart. Referring to the curve for operational technique 2, it will be noted that only 17 percent of the errors exceeded 0.4 foot; 10 percent exceeded 0.6 foot, etc. It has been determined that the error varies approximately as the square root of the distance.

This relationship makes it possible to obtain similar curves for other traverse distances. For example, if the length is made ten miles, new abscissa values are found by multiplying by $\sqrt{10/5} = 1.4$. Thus, for operational technique 2, 17 percent of the errors will now exceed 0.4×1.4, or 0.56 feet; 10 percent will exceed 0.6×1.4, or 0.84 feet.

In conducting field surveys, traverses are "tied" to each other and to bench marks wherever possible. Adjustment of the errors of closure, by standard methods, yields an additional substantial increase in accuracy. Limits are established on individual closure errors, and where necessary, runs are repeated.

The particular technique used in a given area depends on road density, bench mark availability, and the accuracy requirement which is specified. These factors are all studied before the best operational plan is selected.

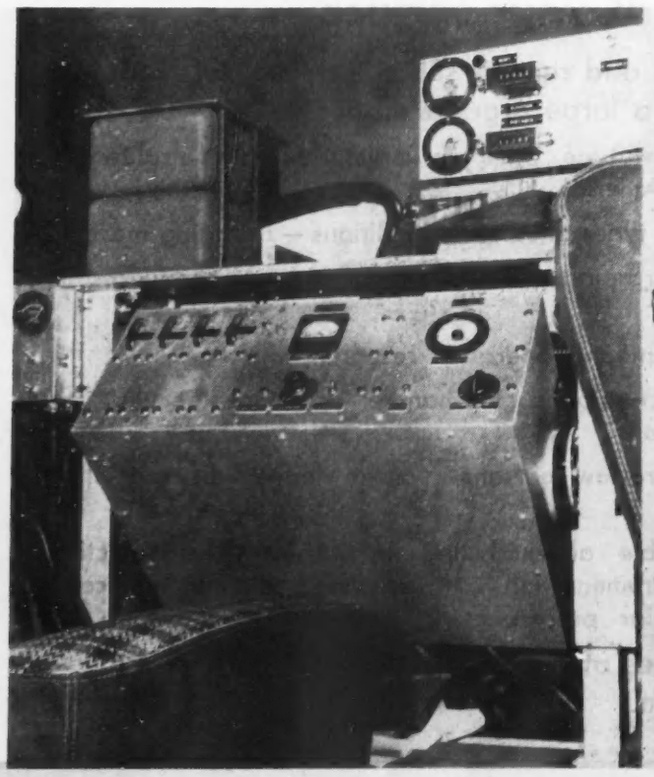


FIGURE 7. Electronic integrator is suspended at angle by rubber supports at either side to an aluminum framework. The mechanical counter, which indicates distance traveled and elevation, is at upper right.

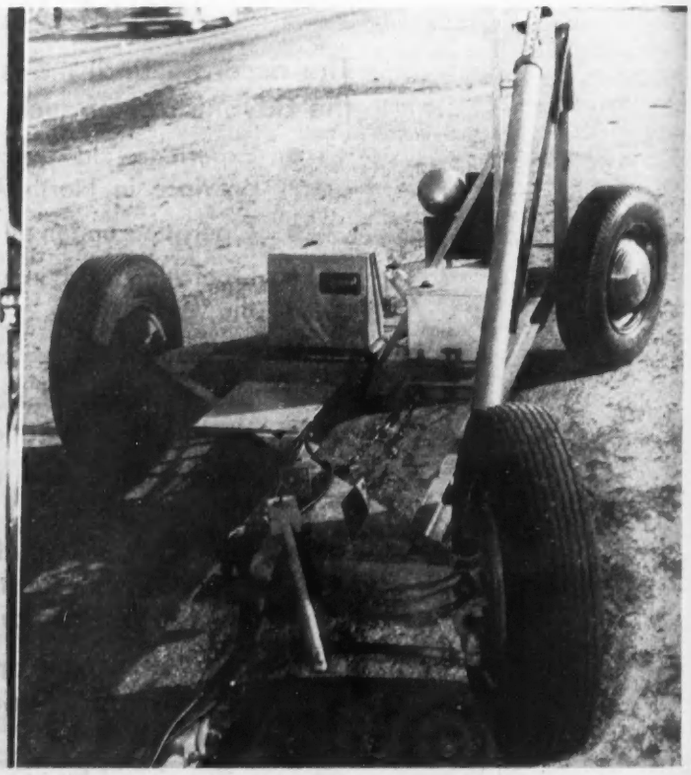


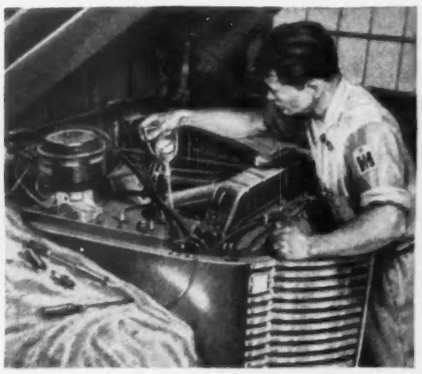
FIGURE 8. Guiding lever has been released and the wheels turned in direction of desired travel. Note how both front and rear wheels track. Guiding cables inter-connecting both wheels are shown.

Check your truck's heavy winter wear here...

It's been a wearing winter—

Maybe a spring leaf snapped during that severe cold snap. That could cause excessive tire wear, misalignment of axles. Or front-end parts may be sprung; that's bad for steering. Brakes may be worn; that's bad for stopping.

But . . . International's specialized spring service is *good* for what ails trucks.



It's been hard under the hood—

What winter weather took out of your engine, we can put back in!

We change oil, inspect, clean, adjust or replace spark plugs, distributor, voltage regulator, carburetor, valves, battery cables, and wiring.

All work is done by International factory-trained mechanics using special equipment.

It's been a tough grind. Here, there and—

Everywhere a truck needs lubrication, it needs lubrication now. So International service experts cover all chassis points, transmission, universal joints, differential, steering gear, wheel bearings, and any other spot that's too dry for its own good. And believe us, they do the job *right!*

It's time to get winter out of your systems—

We'll drain and flush the entire cooling system; refill, adding rust inhibitor, check water pump and cooling connections, check gaskets, hoses, connections and thermostat.

That's how International puts more spring in your truck's systems!

It's overhauling time—for trucks that have been hauling overtime—

4,700 International Dealers, and 170 Company-owned Branches and Service Stations offer you the nation's largest exclusive truck service organization. They're ready with specialized tools and service experience, ready with precision-engineered parts, ready with factory-rebuilt exchange units . . . ready to keep your trucks rolling profitably into spring and summer.

Have your trucks serviced *now* and save money and trouble later!

Other International Harvester Products
Farmall Tractors and Machines
Industrial Power . . . Refrigeration

Tune in James Melton and "Harvest of Stars"
NBC, Sunday afternoons

INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Asphaltic Sands Occurring in Oil Fields

D. B. TALIAFERRO
Senior Petroleum Engineer,
Bureau of Mines, Bartlesville, Okla.

and

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A PECULIAR FORMATION known as "black sand" and which appears to be highly oil saturated is reported in sections of northeast Oklahoma, southeast Kansas and North Texas. During primary production this stratum was considered as a part of the oil-bearing horizon. Since the inception of secondary recovery methods the zone has been studied and laboratory tests indicate that it is non-productive and that efforts to recover the contained hydrocarbons through water-flooding would be futile and costly. A Bureau of Mines study, this article has been approved for publication by the Director of the Bureau of Mines.

ASPHALTIC sands, commonly known as "black sands," are frequently found to be non-productive of oil, although the appearance of sand specimens (cores) indicates that they are highly saturated with organic material. Some laboratory tests also indicate high saturation, but a study made by the Bureau of Mines[1] demonstrates that the organic material in many of these "black sands" should be classified as "asphalt" rather than as "crude oil."

The importance of this conclusion is shown by the fact that retort saturation determinations indicate a reserve in these sands of many million barrels, which is largely non-recoverable if it is asphalt instead of crude oil, as usually believed.

In many oil fields in eastern Kansas, parts of the cores of the oil-bearing formation may appear to be unusually dark and highly saturated with oil. These "black-sand" sections vary widely in thickness throughout any given field; in some places the black sand represents almost the entire formation thickness, and in other nearby wells it may be entirely missing. Saturation determinations made on "black-sand" cores by retorting often indicate the presence of 800 to 1000 barrels of oil per acre foot of sand, although determinations made by extraction methods usually indicate much lower saturations.

These sands are found in many areas where water-flooding operations are in progress. When the cores are tested to determine the amount of oil that can be recovered from them by water-flooding, usually no appreciable amount of water can be forced into them at pressures up to 100 pounds per square inch and no oil can be recovered.

A representative core sample was selected. This was obtained from the Squirrel sand in the Paola Shoestring field in Miami County, Kansas. The well penetrated 41 feet of "sand." Laboratory flooding tests proved that no oil could be recovered from samples from the bottom 13 feet of the core, although retort saturation tests indicated the presence of 760 to 850 barrels of oil per acre-foot of sand. The porosity of this section was found to range from 17.9 to 19.7 percent. (These values probably are low because of the difficulty of completely removing the "hydrocarbons" from the sand before testing it.)

Through the courtesy of the University of Kansas a petrographic study was made. The university laboratory stated that the core was extracted with carbon bisulfide, benzol, ether, and chloroform, but at the end of the treatment it was nearly as dark as the original core. Mechanical analysis of the residue was not satisfactory because many of the particles were aggregates still cemented by "hydrocarbons." The major portion (38 percent) passed through a 120-mesh sieve and was retained on a 170-mesh

TABLE 1

Fraction	Characteristics at 77° F.	Yield Percent
Oils, pentane-soluble	Light-yellow viscous oil	74.6
Resins, pentane-soluble	Reddish-brown, tacky, semi-solid which melted on heating	17.2
Asphaltenes, insoluble in pentane	Black solid which decomposed on heating	5.4
Extraction loss		2.8
		100.0

TABLE 2

Sample	1	2	3
	Percent	Percent	Percent
Water	0.2	0.1	0.4
Ash (Mineral Matter)	96.2	96.9	93.4
Ignition loss (Organic Matter)	3.6	3.0	6.2
Total	100.0	100.0	100.0
Material soluble in carbon bisulfide	0.7	0.3	3.2
Material soluble in benzene	0.5	....	2.2

Characteristics of benzene soluble material—Black, asphalt-like, semisolid which melted or softened abruptly on heating.

TABLE 3

Fraction	Characteristics at 77° F.	Yield Percent
Oils, pentane-soluble	Light-yellow viscous oil	46.6
Resins, pentane-soluble	Reddish-brown, tacky, semi-solid which melted on heating	12.5
Asphaltenes, insoluble in pentane	Black solid which decomposed on heating	38.2
Extraction loss		2.7
		100.0

sieve. Sixteen percent passed a 250-mesh sieve. Three thin sections were prepared from the core, "all of which showed a very fine-grained, well-sorted, unstratified sandstone with bitumen completely saturating the rock." The report concluded, "There does not seem to be any evidence of a significant amount of clay or bentonite. Even if bentonite were present, it is doubtful whether water could act upon it in the presence of so much hydrocarbon."

Chemists of the Bureau of Mines studied the "hydrocarbons" in another specimen of black sand from the same core. Preliminary tests yielded the following results:

	Percent
Water	0.6
Ash (mineral matter)	92.8
Ignition loss (organic matter)	6.6
Total	100.0

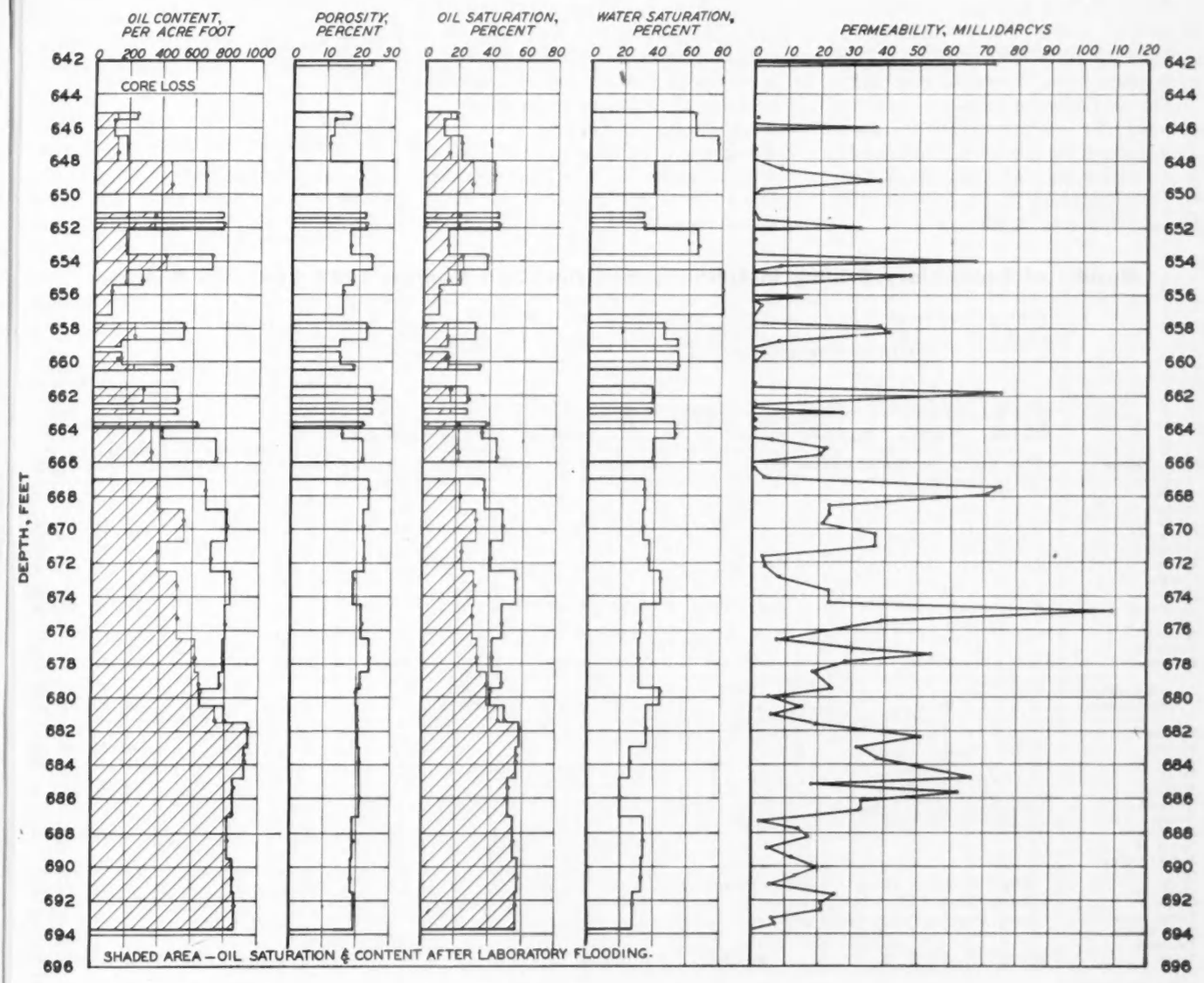
	Percent
Material soluble in carbon bisulfide	3.0
Material soluble in benzene	2.3

Characteristics of material soluble in carbon bisulfide and in benzene. Dark, reddish-brown viscous "asphalt."

The material extracted by carbon bisulfide (3 percent of the sample) was fractionated into the three components, "oils," "resins," and "asphaltenes." However, the fractions from the carbon bisulfide extract were found to contain traces of free sulfur, probably derived from solvent, so they were discarded and the material soluble in benzene (2.3 percent of the sample) was fractionated into oils, resins, and asphaltenes, with the results shown below:

Similar but less complete tests, also were made on three samples of "black sand" from the Quitman field, Wood

■ CONTINUED ON PAGE 88


OIL CONTENT, PER ACRE FOOT
0 200 400 600 800 1000
POROSITY, PERCENT
0 10 20 30
OIL SATURATION, PERCENT
0 20 40 60 80
WATER SATURATION, PERCENT
0 20 40 60 80
PERMEABILITY, MILLIDARCYS
0 10 20 30 40 50 60 70 80 90 100 110 120
CORE LOSS
DEPTH, FEET
642 644 646 648 650 652 654 656 658 660 662 664 666 668 670 672 674 676 678 680 682 684 686 688 690 692 694 696
SHADED AREA—OIL SATURATION & CONTENT AFTER LABORATORY FLOODING.

LINE	DEPTH, FEET From	DEPTH, FEET To	Thickness, Feet	Average Porosity	Average Oil Saturation	Average Water Saturation	Average Oil Content Bbl. per Acre Ft.	Total Oil Content Bbl. per Acre Ft.	Average Permeability
1	648.0	664.6	7.9	21.3	35	44	575	4,540	38
2	664.6	679.5	13.9	21.9	45	36	769	10,690	30
3	648.0	679.5	21.8	21.7	42	39	699	15,230	33
4	679.5	693.7	14.2	19.9	55	32	847	12,030	23

Analysis of a core from the Paola Shoestring, Franklin County, Kansas, containing more than 14 feet of "Black Sand" at the base of the oil producing sand.

Wyoming Wildcat Nears

18,000 Feet

By CECIL SMITH
Staff Writer

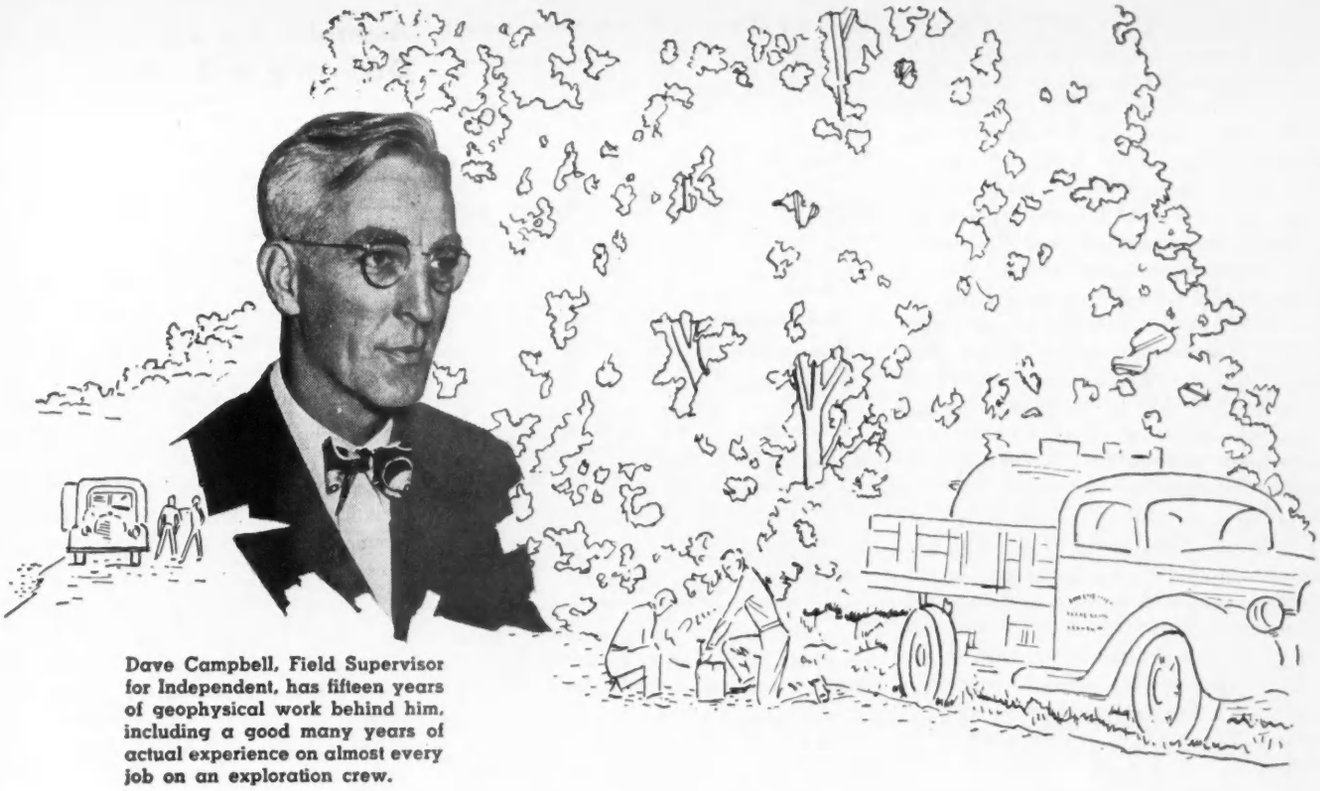
THE world's deepest well has been abandoned after penetrating to 18,734 feet. This California wildcat lowered the previous depth record by almost 1000 feet and was the first test to reach the 18,000-foot mark. The possibility that this mark may be long-lived is lessened every day as a Wyoming test, being drilled by the same operator, continues to make hole below the 17,800-foot level. This wildcat is attracting considerable attention because it is being drilled by the industry's largest rig, rated as capable of drilling to 20,000 feet.

While this year seems fairly certain of becoming one noted for its depth champions, it also shows possibility of becoming an active exploratory drilling year. This possibility is not particularly borne out by the activity in the first two months, for there has been an appreciable slackening in wildcat drilling. However, this is attributable mainly to weather conditions and the same was true last year when adverse weather kept drilling down for the first three months before it could hit its stride to make 1948 the record exploratory year of all times. At the end of two months, the number of exploration wells completed showed only a slight decline from the same period of 1948.

The new champion, The Superior Oil Company's Limoneria No. 1, Ventura County, California, reached its depth with little difficulty, although the work was done with ordinary deep well tools. It is understood that only one fishing job was necessary and that was accomplished with relative ease. This new mark exceeded by 911 feet the previous

Results of Exploratory Drilling in February and First Two Months, 1949-1948, By Districts

State or District	MONTH OF FEBRUARY, 1949														FIRST TWO MONTHS, 1949																	
	Productive Tests										Unproductive Tests				Productive Tests									Unproductive Tests					Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive				Total Exploratory Tests	New Fields			New Pays			Extensions			Total Productive								
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	2 Mo. 1949	2 Mo. 1948	Wildcats	New Pays	Outposts	Total Dry 2 Mo. 1949	Total Dry 2 Mo. 1948	2 Mo. 1949	2 Mo. 1948
Alabama																										1			1	2	1	2
Arizona											1			1												1			1		1	
Arkansas											5			5	1			1						2	1	8			8	14	10	15
California			1	1			1			3	12			15	2		1	1			2			6	4	12			12	43	18	47
Colorado											1			1												3			3	12	3	12
Florida																										2			2	3	2	3
Georgia											1			1												1			1		1	
Illinois	1			1			7			9	33			42	1			4			9			14	13	67			67	72	81	85
Indiana	3			2						5	21			26	8			2						10	3	59			59	21	69	24
Iowa																																
Kansas	3		1				1			5	21			26	9		2				2			13	10	52			52	62	65	72
Kentucky											1			1	1									1	2	2			2	3	3	5
Louisiana				2	2		2			6	15			21	3	1	1	2	4		2			13	14	30			30	25	43	39
North Louisiana											8			8	1	1	1		1					4	1	16			16	12	20	13
South Louisiana				2	2		2			6	7			13	2			2	3		2			9	13	14			14	13	23	26
Maryland																														1		1
Michigan	1		1							2	23			25	2		1				2			5	4	54			54	42	59	46
Mississippi	1									1	5			6	1									1		11			11	15	12	15
Missouri																																
Montana											1			1											1	5		..	5	8	5	9
Nebraska																																
Nevada																																
New Mexico	1									1	4			5	1			1						2	5	7			7	9	9	14
New York																																
North Carolina																																
Ohio							1			1	2			3							1			1	2	6			6	8	7	10
Oklahoma		2		1		1	2			6	13			19	5	2		3		1	2			13	18	52			52	78	65	96
Oregon																																
Pennsylvania																										1			1	2	1	2
South Dakota																																
Tennessee															1									1		2			2	4	3	4
Texas	23	6	1	7	1	3	7			48	148		4	200	49	9	6	20	5	4	9			102	99	336		6	342	319	444	418
Dist. 1 S. Central											21			21	1									1	1	38			38	28	39	29
Dist. 2 Middle Gulf	1	2								3	12		2	17	2	5	2			1				10	14	22		3	25	32	35	46
Dist. 3 Upper Gulf	1	1		2			1			5	22			27	4	1		6			3			14	14	48			48	42	62	56
Dist. 4 L. Gulf-SW		1	1	3	1	3				9	31		1	41	1	1	1	7	3	3				16	15	57		2	59	54	75	69
Dist. 5 E. Central		1								1	6			7		1								1	3	11			11	13	12	16
Dist. 6 Northeast		1								1	2			3		1	1		2					4	5	6			6	15	10	20
Dist. 7-B N. Central	10			1			1			12	22			34	21		2	3			1			27	15	79			79	52	106	67
Dist. 7-C W. Central											2			2	2									2	5	4			4	15	6	20
Dist. 8 West	2			1			3			6	9			15	4			2			3			9	12	18			18	25	27	37
Dist. 9 North	9						2			11	21		1	33	14			2			2			18	15	53		1	54	43	72	58
Dist. 10 Panhandle																																
Utah											2			2												3			3	4	3	4
Virginia																									1							1
Washington																																
West Virginia																	1							1					1			
Wyoming	1			1						2	5		1	8	2			3			1			6	5	10		1	11	5	17	10
Total U.S.	34	8	4	15	3	4	21			89	314		5	408	86	12	12	37	9	5	30			191	182	725		7	732	752	923	934



Dave Campbell, Field Supervisor for Independent, has fifteen years of geophysical work behind him, including a good many years of actual experience on almost every job on an exploration crew.

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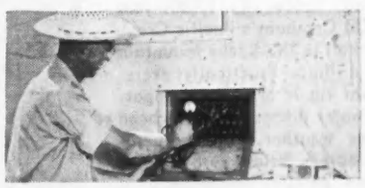

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POINTING THE WAY IXC FOR THE DRILL

Independent
EXPLORATION COMPANY
Geophysical Surveys
ESPERSON BUILDING HOUSTON, TEXAS

record drilled by the same operator in Caddo County, Oklahoma, in 1947.

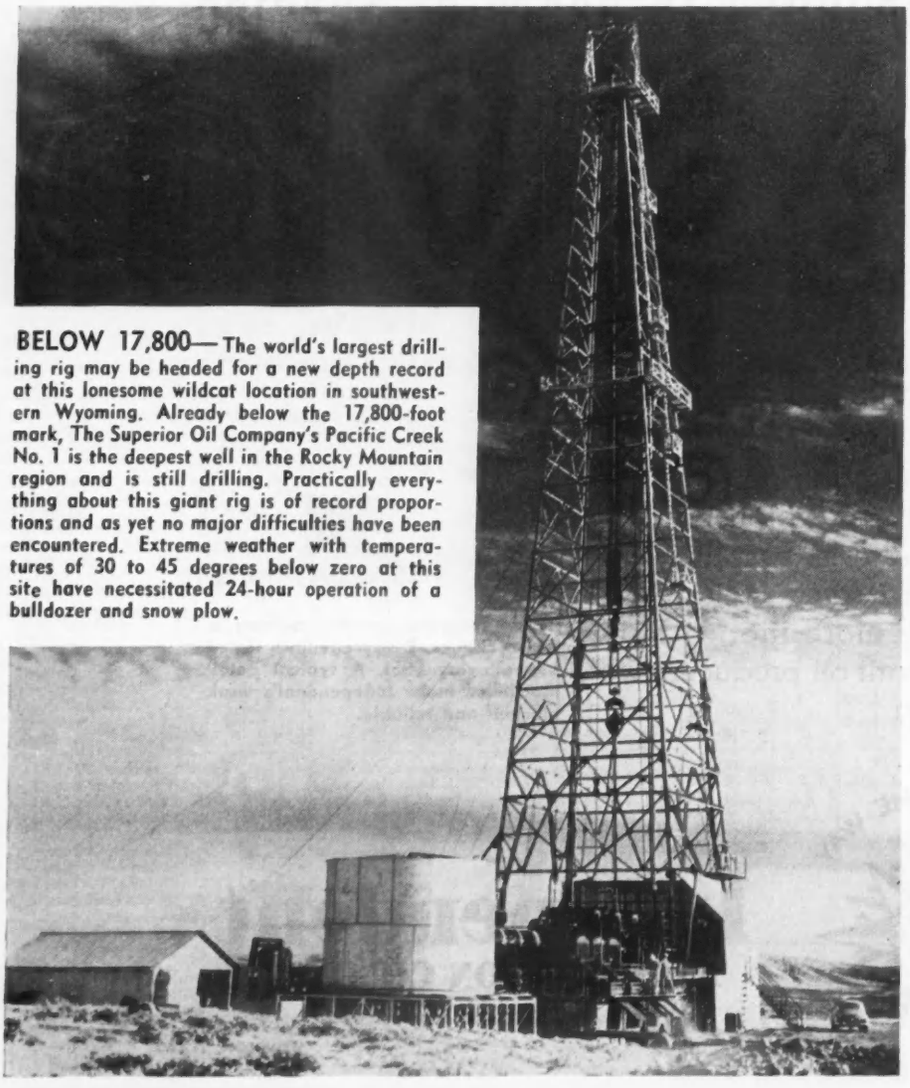
Superior appears well on its way to make it three in a row. Its southwestern Wyoming wildcat, Pacific Creek 1, was drilling below 17,800 feet and only a little more than 900 feet short of the new California record. Good fortune has attended this operation, and the industry's largest rig has been able to proceed without major mishap despite temperatures of 30 to 45 degrees below zero during the nights and seldom above zero during the day. The most severe winter on record in Wyoming made around-the-clock operation of a bulldozer and snow plow necessary to keep the location's road open.

Exploratory drilling resulted in the completion of 923 wells in the first two months of this year against 934 in the same period of 1948, for a decline of 1.2 percent. In both periods, activity was considerably less than it had been in the closing months of the previous years, but these were normal seasonal trends reflecting the effects of winter weather on drilling.

Slowness in exploratory drilling continued through March last year before it began to pick up momentum to put the year far out in front of any year in history in number of wells completed. This year with about the same start as 1948 could equal or better that year's record, for pipe shortages that hindered the 1948 program should be less serious in 1949. (SEE TABLES ON PAGES 90-92)

Summary of Results of Exploratory Drilling

ITEM	Feb., 1949	Jan., 1949	TWO MONTHS Jan.-Feb. 1949	1948	Percent Diff.
Oil Discoveries	49	74	123	126	— 2.4
New Fields	34	52	86	77	+ 11.7
New Pays	15	22	37	49	— 24.5
Distillate Discoveries	11	10	21	14	+ 50.0
New Fields	8	6	12	6	+100.0
New Pays	3	4	9	8	+ 12.5
Gas Discoveries	8	9	17	18	— 5.6
New Fields	4	8	12	13	— 7.7
New Pays	4	1	5	5	.....
Total Discoveries	68	93	161	158	+ 1.9
Extensions to Fields	21	9	30	24	+ 25.0
Oil Fields	21	9	30	19	+ 57.9
Distillate Fields	.....	.....	.....	1	—100.0
Gas Fields	.....	.....	.....	4	—100.0
Total Prod. Tests	89	102	191	182	+ 4.9
Dry Holes	319	413	732	752	— 2.7
Wildcats	314	411	725	741	— 2.2
New Pays	.....	.....	.....	2	—100.0
Outposts	5	2	7	9	— 22.2
Total Expl'tory Tests	408	515	923	934	— 1.2
Percent Productive	21.8	19.8	20.7	19.5	.....
Percent Dry	78.2	80.2	79.3	80.5	.....



BELOW 17,800— The world's largest drilling rig may be headed for a new depth record at this lonesome wildcat location in southwestern Wyoming. Already below the 17,800-foot mark, The Superior Oil Company's Pacific Creek No. 1 is the deepest well in the Rocky Mountain region and is still drilling. Practically everything about this giant rig is of record proportions and as yet no major difficulties have been encountered. Extreme weather with temperatures of 30 to 45 degrees below zero at this site have necessitated 24-hour operation of a bulldozer and snow plow.

Asphaltic Sands Occurring in Oil Fields

■ CONTINUED FROM PAGE 85

County, Texas. These samples were from the Paluxy sand, which occurs in the area of the Quitman field at a depth of about 6,150 feet. The first two samples were from the same well, the third from a well on another lease. The results of the preliminary tests on these samples are as shown in Table 2.

Results obtained by fractionating the benzene soluble material from sample 3 into oils, resins, and asphaltenes are shown in Table 3.

The general similarity in the characteristics of the benzene soluble material from the Kansas and Texas cores is evident.

Discussion of Results

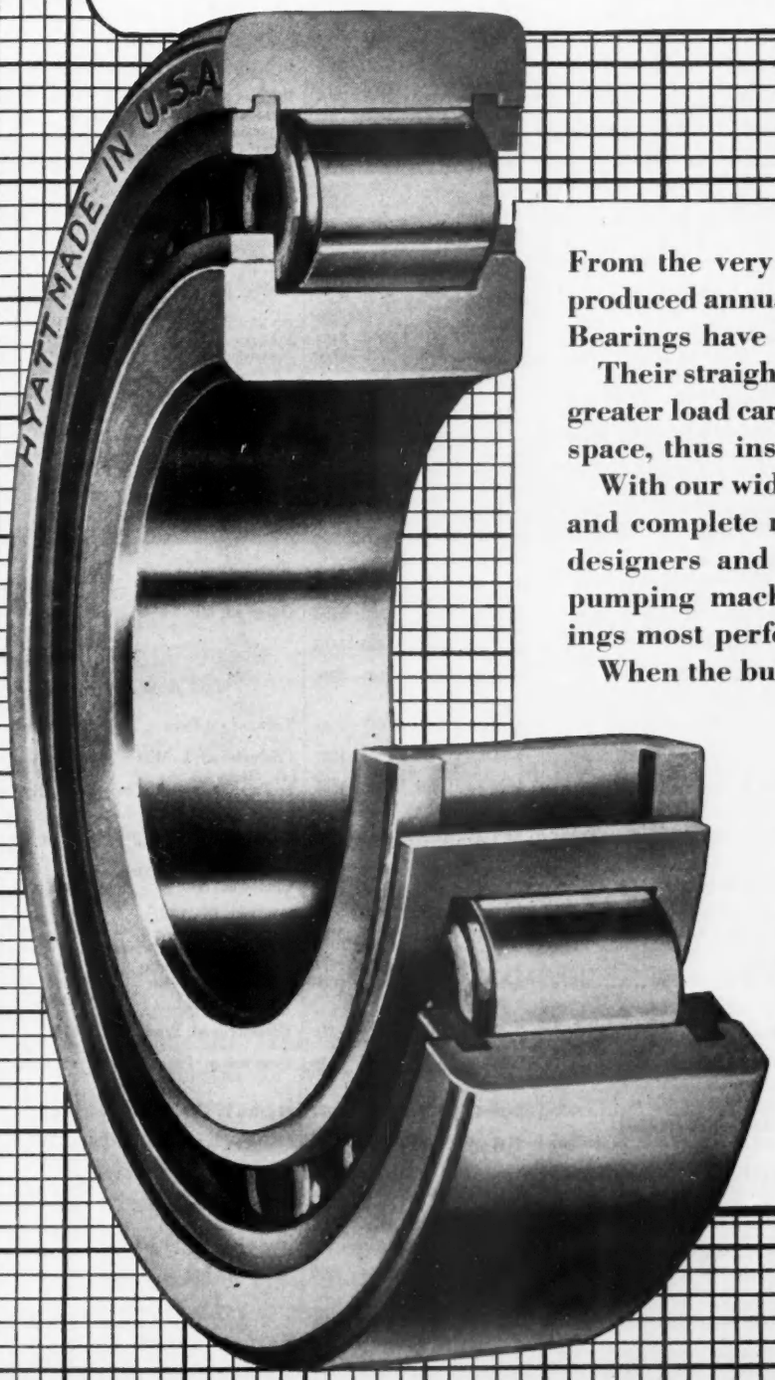
It will be noted that the benzene-soluble material in the core sample from Miami County, Kansas, constituted only about 35 percent of the total organic content of the sample. This was based on the assumption that the ignition loss represented only organic material and was not due partly to decomposition of inorganic material. The remaining 65 percent of the organic matter was insoluble in benzene and may thus be classified as "asphaltic pyrobitumen." No attempt was made to isolate this material from the sand as asphaltic pyrobitumens generally are insoluble, friable solids that are virtually infusible and decompose upon being heated. As the "oil" found in the sample was viscous and amounted to only 26 percent of the total organic matter in the core (all other fractions being solids or semi-solids), it is evident that little if any crude oil is present that could be produced by water flooding or other usual oil-field methods.

The benzene-soluble component was 35 percent of the total organic material in Sample 3 from Wood County, Texas. However, only 47 percent of the benzene-soluble component, or 17 percent of the total hydrocarbon content, was found to be oil. As the oil fraction was viscous and as the remaining fractions were solids or semi-solids, it is evident that this material cannot be produced by present day methods. The hydrocarbon content of Samples 1 and 2 from Woods County, Texas, were 81 and 90 percent pyrobitumen, respectively, which probably would plug the pores of the oil sand regardless of the characteristics of the other hydrocarbon fractions.

REFERENCE

[1] AAPG Bulletin, Vol. 30, No. 4, April, 1946.

BUILT FIRST —TO LAST



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HYATT ROLLER BEARINGS

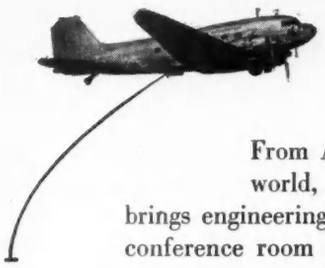
New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in February, 1949

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Producion Method and Choke	Grav. ity of Oil
		CALIFORNIA—New Oil Pay						
San Luis Obispo	Russell Ranch	Richfield Oil Corp's F. R. Anderson 18-30, 607 n 577 e fr swc Sect 30-11n-27w, Cuyama Valley.	2- 7-49	3642	3478- 3638	Temblor-Vaqueros Sd; Mio	F 1320; ½"	37.8
		CALIFORNIA—Oil Field Extension						
Fresno	Jacalitos	The Texas Co's Sherman 74-20, Sect 20-21s-15e, ½ mi w extension	2-21-49	3527	3438- 3525	Temblor sd; Mio	F 514; 1/16"	39.5
		CALIFORNIA—New Gas Field						
Kern		Pacific Western Oil Corp's Midway-McKittrick A-14-30, 330 n&e fr w¼ cor Sect 30-30s-22e, Fault block disc, 1 mi w Belgian Anticline fld.	2- 7-49	5833	5220- 5320		4 mln; 24/64"	
		ILLINOIS—New Oil Field						
Jasper	St. Marie, W.	V. W. Smith & M. S. Coffman's W. Ochs 1, se sw ne 35-6n-10e, 3 mi nw St. Marie fld.	2-15-49	2844	2813- 2815	McClosky li; Miss	P 175	
		ILLINOIS—New Oil Pay						
Gallatin	Junction	George S. Engle's R. V. Stinson 1, ne se sw 9-9s-9e, ½ mi fr prod.	2-28-49	2139	2118- 2123	Hardinsburg sd; Miss	P 35	
		ILLINOIS—Oil Field Extensions						
Clay	Sailor Springs Consol.	Hed Oil Co's Cambron-Cooper 1, ne sw sw 14-4n-7e, ¾ mi n extension	2-15-49	2596	2584- 2594	Cypress sd; Miss	P 50	
Clay	Stanford	R. P. Johnson-Calvert & Willis' Pearce-Weiler Cons 1, sw sw sw 19-3n-8e, ¾ mi se extension.	2-15-49	3087	3016- 3019	Rosiclare li; Miss	P 130	
Jasper	St. Marie	Orville Smalley's John Steber 1, se se sw 7-5n-14w, 1 mi sw extension	2- 8-49	2903	2896- 2901	McClosky li; Miss	P 84	
Wabash	Allendale	F. L. Beard's B French 1, se sw nw 32-2n-12w, 1¼ mi extension	2-22-49	2420	2163- 2166	Bethel sd; Miss	P 15	
Wabash	Maud Consol.	Calvert & Willis et al's J. W. Reisinger 1, se ne ne 4-2s-13w ½ mi w extension	2-15-49	2412	2401- 2405	Cypress sd; Miss	P 275	
White	Grayville, W.	C. E. Brehm's Blackford 1, se nw ne 34-3s-10e, ¾ mi s extension	2- 8-49	2862	2839- 2861	Cypress sd; Miss	P 110	
White	Roland	Kingwood Oil Co's W. C. Hill 1, ne ne sw 36-6s-8e, ½ mi ne extension	2-15-49	3055	3027- 3033	McClosky li; Miss	P 69; 19 wtr	
		INDIANA—New Oil Fields						
Huntington		H. W. Scott's Lloyd L. Lohr 1, 330 fr n&wl ne ne Sect 2-26n-9e	1-22-49	979	972- 979	Trenton sd; Ord	P 12	
Knox		Earnest Zink's Brooks Bond 1, nw se sw 7-5n-9w	2-28-49	810	797- 810	Pennsylvania sd; Penn	P 19	
Spencer		Mulzer Brothers' Robert Davis 2, se ne ne Sect 12-7s-8w	1-19-49	1051	1038- 1051	Waltersburg sd; U Miss	P 11	
		INDIANA—New Oil Pays						
Posey	College	Geo. C. Schoonmaker's Bishop Grimmelsman 1, (Catholic Church) se se se 9-8s-14w.	2-28-49	2769	1730- 1740	Palestine sd; U Miss	P 55	
Vanderburgh	Vienna, S.	W. O. Morgan's Walter Boeke 1, nw nw se Sect 6-6s-11w	1- 5-49	2609	2602- 2609	McClosky sd; Miss	P 160	
		KANSAS—New Oil Fields						
Barton	Workman, SE	E. H. Adair's Lanterman 1, nw nw se 34-20s-12w, ½ mi s&e Workman pl.	2-28-49	3415	3390- 3401	Arbuckle li; Ord	P 189	
Sedgwick	Bartholomew, N.	J. M. Huber Corp & Pabco Drlg Co's Berk 1, sw se ne 30-27s-4w, ¾ mi ne Bartholomew pl.	2-28-49	3748	3712- 3748	Mississippi sd; Miss	F 677; 14/64"	
Stafford	Gates, S.	W. F. Faulkner et al's Gates 1, nw nw nw 3-22s-13w, 1 mi s Gates pl & 1 mi se Hufford pl.	2-28-49	3756	3748- 3756	Arbuckle li; Ord	P 135	
		KANSAS—Oil Field Extension						
Russell	Trapp	E. H. Adair's Pfeister 1-A, sw se nw 24-15s-13w, ¾ mi ne extension	2-28-49	3331	3092- 3100	Lansing li; Penn	P 749	
		KANSAS—New Gas Field						
Harvey		Mallard Drlg. & Westgate-Greenland's Howard 1, se sw nw 15-23s-3w, 2 mi e Burrton pl.	2-15-49	3386	3315- 3384	Mississippi sd; Miss	13 mln.	
		SOUTH LOUISIANA—New Oil Pays						
Acadia	Egan	Sun-Sohio's Limbocker Unit 1, Sect 38-9s-1w	2-17-49	10758	10104-10108	Miocene	F 138; 7/64"	38.5
Plaquemines	Pointe a la Hache	S. W. Richardson's Humble-Morgan City Ld & Fur Co. 1-E, Sect 2-71s-14e	2-25-49	10972	10677-10682	Miocene	F 358; 5/32"	34
		SOUTH LOUISIANA—Oil Field Extensions						
Beauregard	Hurricane Creek	Magnolia Pet Co's Doornbos-McPherson 1-H, Sect 25-5s-8w, ¾ mi e extension.	2- 8-49	9100	8280- 8287	Cockfield sd; Eoc	F 38; ⅛"	46.5
Jeff Davis	W. Tepetate	W. T. Burton's Milton LeBlanc 1, Sect 2-8s-3w, 1 mi off sw flk of fld.	2-16-49	8471	8406- 8408	Ortego sd; Mio	F 240; 3/64"	35
		SOUTH LOUISIANA—New Distillate Pays						
LaFourche	Leeville, SE Flk	The Texas Co's City of New Orleans 6, Sect 35-21s-22e	2-27-49	13820	13360-13410		F 49; 0.7 mln; 1/8"	47
Terrebonne	Pointe Au Fer	The Texas Co's Point Au Fer Unit 1, Sect 35-20s-11e	2- 5-49	11500	9862- 9866		F 75; 7.3 mln; 5/32"	48.9
		MICHIGAN—New Oil Field						
Muskegon	Trent	P. K. Degenther's Herman 1, se se ne 19-10n-13w, Casnovia Twp.	2- 2-49	2042	2038- 2042	Traverse sd; Devo	F 90; 10 wtr	42
		MICHIGAN—New Gas Field						
Ogemaw		Sun Oil Co's Prescott et al 1, nw se nw 25-22n-4e, Logan Twp.	2-11-49	3129	1230- 1237	Coldwater sd; L. Miss	0.6 mln.	
		MISSISSIPPI—New Oil Field						
Franklin	Bude	Barnsdall Oil Co's J. Pittman 1, 530 e 450 n swc sw nw 29-5n-4e, 6 mi s Bude Twp.	2- 1-49	11308	11090-11098	L. Tuscaloosa sd; U Cre	F 356; 11/64"	43.8
		NEW MEXICO—New Oil Field						
Lea		Stanolind O&G Co's State 1-U, 660 fr s&el Sect 2-20s-38e 4½ mi s of Hobbs fld.	2- 2-49	10014	6990- 7149	Tubb sd; Perm	P 41; 46 wtr.	39
		OHIO—Gas Field Extension						
Lorain	Ashland-Lorain	Harmon & McManaway's Lorain Co Agricultural Society 1, Lot 34, Wellington Twp.	2- 8-49	2318	2252- 2295	Clinton sd; Sil	0.9 mln	
		OKLAHOMA—New Oil Pay						
Noble	Fourdee	Mazda Oil Corp's Merriman 1, se se nw 26-22n-2w, also west extension	2-28-49	5146	5116- 5146	2nd Wilcox sd; Ord	F 192; 13/64"	
		OKLAHOMA—Oil Field Extension						
Osage	Remington	A. G. Oliphant's Dellaplain 1, se sw sw 7-25n-6e	2- 2-49	2975	2970- 2974	Mississippi chat; miss	F 141	41.5
Beckham	Elk City	Shell Oil Co's Long 1, c ne sw 15-10n-21w, 1 mi w extension	2-24-49	10500	9040- 9080	Granite wash; Penn	F 2345; 72 wtr; 1"	49.1
		OKLAHOMA—New Distillate Fields						
Garvin		Davon Oil Co's Layton 1, se sw se 36-3n-3w	2-17-49	7430	7306- 7348	Hartshorne sd; Penn	F 115; 2.8. mln; ½"	53
Hughes	Pecan Grove	Gulf Oil Corp & F. B. Murta's Davis 1, sw sw nw 20-8n-9e	2-17-49	3346	3331- 3346	Cromwell sd; Penn	F 12; 8 mln; 1/16"	
		OKLAHOMA—New Gas Pay						
Lincoln		Regent Oil Co's Angel 1, nw nw se 35-14n-6e	2-28-49	4205	4047- 4072	Hunton li; Devo	8 mln.	
		TEXAS—District 2 (MIDDLE GULF COAST)—New Oil Field						
Goliad	"Fannin"	Placid Oil Co's Robie N. Wells 1, 2500 fr nwl 9500 fr wl Juan Rener Sur, 2 mi se Fannin.	2-11-49	4815	3721- 3729		F 85; ⅛"	25
		TEXAS—District 2 (MIDDLE GULF COAST)—New Distillate Fields						
Bee		Dirks Bros & Tide Water Assoc Oil Co's C. A. Dugat 2-C, 2200 fr nwl 467 fr nel James Gray Sur, 1 mi w Dirks fld.	2-15—49	7557	7530- 7538	Wilcox sd; Eoc	F 357; 12.5 mln.	
Goliad		Humble O&R Co's B. T. Powell et al 1, 330 fr swl 1980 fr sel 1017.4-ac Lse, W. D. Sutherland Sur, 1 mi n Hord's Creek fld.	2- 5-49	9005	7655- 7665		F 57; 4.4 mln; 1/4"	
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Field						
Newton	Old Salem	The Texas Co's Newton County Lumber Co. 1, 2970 fr wl 1696.6 fr el of Lse, Jonathan D. Ray Sur, 6 mi e Call fld.	2- 6-49	12610	9644- 9660	Wilcox sd; Eoc	F 44; 1/16"	44.2
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Pays						
Liberty	S. Liberty (SE Flk)	W. A. Moncreif's A. Duessen 1, (OWDD) 19.34-ac Lse David Michey Lge	2-28-49	6117	6068- 6078		F 138; 5/64"	
Tyler	E. Hillister	Humble O&R Co's Wm. Rice Institute 2, 1440-ac Lse, Arthur Hutchins Sur.	2- 9-49	9538	7346- 7350		F 72; 1/16"	46.1
		TEXAS—District 3 (UPPER GULF COAST)—Oil Field Extension						
Galveston	Hitchcock	Stewart Pet Co's Fred Thomas et al 1, 400-ac lse, John D. Moore Sur., east extension.	2-27-49	6739	6524- 6528	Miocene	F 97; 1/32"	33.7

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.



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Pictured here is a typical section of the Mozambique coastland seen from a height of three miles. At the right, off-shore underwater formations are seen in striking detail.

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New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in February, 1949—Continued

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Producion Method and Choke	Gra v. ity of Oil
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Field						
Galveston..	"Hannah Reef"	Sun Oil Co's State-Hannah Reef 1, 1320 fr nwl 660 fr nel Sect 232, Galveston Bay, 7 mi se Red Fish Reef fld.	2-17-49	11009	10674-10688	.....	F 215; 2.9 mln; 5/16"	52.8
		TEXAS—District 4 (LOWER GULF-SW)—New Oil Pays						
Aransas....	Fulton Beach.	Stanolind O&G Co's State Tr 82-1, State Tr 82, Aransas Bay	2- 5-49	7522	7052- 7058	.....	F 45; 1/8"	44
Nueces....	Saxet-Frio....	The Chicago Corp's Rand Morgan 1, 219-1-ac Lse, Sect 6, J. R. Ward Sur.	2-17-49	10799	7224- 7227	.....	F 70; 11/64"	30.9
San Patricio	Plymouth, E..	F. M. Boykin, Jr's W. P. Mullen 1, (OWDD) 1400 fr nl 466 fr wl Blk 1, Sect 27.	2-10-49	5525	5481- 5491	.....	F 123; 1/8"	28.5
		TEXAS—District 4 (LOWER GULF-SW)—New Distillate Field						
Hidalgo....	Edinburg.....	Magnolia Pet Co's Carlson Unit 1, 330 fr sl 486 fr wl Lot 7, Blk 1, A. J. McCall Subdn, Porc 68, 2 mi sw Edinburg.	1- 7-49	11246	7580- 7640	.....	F 121; 15 mln	53.5
		TEXAS—District 4 (LOWER GULF-SW)—New Distillate Pay						
Hidalgo....	Mercedes.....	V. E. Cook, Tr's J. & C. Royalty Corp 1, Farm Tr 2345, Blk 58, N. Capisallo Subdn, Two new Horizons	2- 1-49	8563	6858- 6775	.....	F 186; 5.2 mln; 1/4"	....
					6969- 6980	.....	F 53; 1.9 mln; 1/4"	53
		TEXAS—District 4 (LOWER GULF-SW)—New Gas Field						
Duval.....	.....	Magnolia Pet Co's Duval Co Ranch Co. 6, 330 fr ne&sel Blk 10, Duval CSL, 2½ mi w of sw end Cedro Hill fld.	2-28-49	2503	1413- 1418	Cole sd; Eoc	16 mln; open	....
		TEXAS—District 4 (LOWER GULF-SW)—New Gas Pays						
Aransas....	Lamar.....	Sullivan & Garnett's United North & South Dev Co 1, Lot 123 of Lamar Twst 3½ mi nw of oil prod.	1-12-49	7275	7024- 7035	.....	1.1 mln; 1/8"	....
Starr.....	Roma.....	The Texas Co's Virginia Cox de Guerra 7-A, Share 92, Porcion 68.....	2-14-49	10222	1104- 1115	.....	0.5 mln; 1/4"	....
Webb.....	Quien Sabe...	O. W. Killam's Bruni Est 20, 1456-ac Lse, Sur 77.....	2- 2-49	3723	2670- 2675	Holbein sd; Eoc	5 mln; open	....
		TEXAS—District 5 (E. CENTRAL)—New Distillate Field						
Freestone..	.....	Humble O&R Co's R. P. McWatters 1, 330 fr wl, 500 fr sl Geo. Lamb Sur, 7½ mi se Teague.	2-23-49	16347	8315- 8400	Pettit sd; L. Cre	F 103; 6.5 mln; open	53.6
		TEXAS—District 6 (NORTHEAST)—New Distillate Field						
Cherokee...	.....	Standard of Texas' T. E. Acker et al 1, 467 fr nl 1250 fr el T. R. Walker Sur, 2½ mi nw Maydell.	2-14-49	8763	8610- 8650	Rodessa sd; L Cre	F 23; 5.1 mln	....
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Fields						
Brown.....	.....	J. O. Smith et al's A. G. Norton 1, 1375 fr el 150 fr sl of n½ of nw¼ Blk HT&B Sur, 1 mi e Bangs.	2- 9-49	995	983- 995	.....	P 6	....
Callahan...	.....	Chas. E. Thornton, Tr's Fred W. Story 2, 450 fr nl 150 fr el of 20-ac Lse, Blk 42, Lge 181, Comal CSL, 5 mi sw Cross Plains.....	2-12-49	459	450- 459	.....	P 9	39
Eastland...	.....	G. E. Kadane & Sons' Whitesides 1, 8250 fr wl 8000 fr nl of J. Ruvarth Sur, 8 mi ne Rising Star.	2- 2-49	2829	2740- 2817	Marble Falls sd; Penn	P 6	42
Eastland...	.....	Lone Star Production Co's C. J. Kleiner 1-C, 330 fr e&sl of se¼ Sect 71, Blk 4, H&TC Sur, 9 mi ne Cisco.	2-21-49	4084	3527- 3540	.....	F 292; 32 wtr; 3/8"	42
Haskell....	.....	Danciger O&R Co's C. L. Bogard 1, 1177 fr nl 1061 fr el of s 348-acs of Sect 239, Blk 45, H&TC Sur, 4½ w Rochester.	2-20-49	5199	5023- 5027	Strawn sd; Penn	F 180; 2070 wtr	39.2
Haskell....	.....	Pan American Prod Co's Geo. Kieke 1, 990 fr sl 2475 fr wl MEP&P Sur, 2 mi se Stamford.	2-20-49	2945	2280- 2298	Gunsight li; Penn	P 29	36.9
Jones.....	Jones Co. Reg.	Roark, Hooker & Roark et al's Alec Carter et al 1, 1400 fr el 467 fr sl Sect 53, Blk 18, T&P Sur, 1½ mi n Noodle.	2-22-49	3040	2772- 2776	Hope sd; Penn	P 185	40
Stephens...	.....	Star Oil Co. Inc's Robert Jackson 1, 660 fr el 1320 fr sl Sect 77, Blk 4, T&P Sur, 5 mi e Frankel.	2-28-49	1723	1716- 1723	.....	P 58	....
Stephens...	.....	The Texas Pacific Coal & Oil Co's Harold Singleton 1, 660 fr n&el Sect 203, TE&L Sur, 6 mi sw Breckenridge.	2-25-49	4235	3174- 3196	.....	P 77	43
Stephens...	.....	The Texas Pacific Coal & Oil Co's S. L. Harris 1, 660 fr el 2918 fr sl Sect 17 T&P Sur, 10 mi se Breckenridge.	2-13-49	4138	3734- 3744	Marble Falls li; Penn	F 194; 231 wtr; 3/4"	41
					3880- 3896	Duffer sd; Penn	5 mln	....
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Pay						
Fisher.....	Robey.....	Lion Oil Co & Exploration Drlg Co's C. J. Hale 2, ne¼ Lot 27, Lge 317, El Paso CSL.	2-10-49	4074	4044- 4055	Swastika sd; Penn	F 143; 1/2"	44.1
		TEXAS—District 7-B (NORTH CENTRAL)—Oil Field Extension						
Throck-morton	Sztykgold....	Fred M. Manning Inc's Goodstein-Brown 1-L, 2000 fr el 467 fr sl Sect 215, BBB&C Sur, 1½ mi nw extension.	2-25-49	5143	4550- 4560	Caddo li; Penn	P 70	40
		TEXAS—District 8 (WEST)—New Oil Fields						
Cochran...	.....	Edwin B. Cox & Jake L. Hamon's D. C. Reed 1, 660 fr n&wl Sect 40, Harrison & Brown Sur, 3½ mi se of Masten fld.	2-22-49	5250	5025- 5055	.....	P 50	26
Winkler....	"Flying W"..	Gulf Oil Corp's Keystone Cattle Co. 135-D, 660 fr nl 1980 fr wl Sect 2, Blk B-1, PSL Sur, 7 mi e Keystone-Ellen fld.	2-25-49	9744	9715- 9721	Devonian sd; Devo	F 1557; 1/2"	38.4
		TEXAS—District 8 (WEST)—New Oil Pay						
Crane.....	C-Bar.....	Gulf Oil Corp's Hattie Connell et al 3-G, Sect 27, Blk B-22, PSL Sur.....	2-24-49	3549	3520- 3549	San Andres li; Perm	F 199 3/8"	35.2
		TEXAS—District 8 (WEST)—Oil Field Extensions						
Ector.....	Cowden, S....	Amerada Pet Co's TXL 1-F, Sect 5, Blk 43, T-3-S, T&P Sur, 1 mi w extension.	2- 3-49	4220	4098- 4175	San Andres li; Perm	F 138; 2"	36.2
Pecos.....	Lehn, N.....	Condor Pet Co's Geo. T. Abell 1, Sect 35, Blk 10, H&GN Sur ½ mi s extension.	2-24-49	2005	1990- 2005	.....	P 10	35
Pecos.....	Toborg.....	J. L. & W. H. Cooper Wilson 1, Sect 1, Blk 194, GC&SF Sur, 1½ mi w extension.	2- 1-49	1495	1418- 1440	.....	P 40	33
		TEXAS—District 9 (NORTH)—New Oil Fields						
Archer.....	.....	L. H. Choate et al's A. Abercrombie 1, Wm. A. Hassell Sur, 2 m ise Archer City.	2- 4-49	3725	3713- 3725	.....	F 458;1/4"	42
Archer....	.....	Noranda Pet Co's H. O. Prideaux 1, 330 fr nl 4480 fr el J. Dorsey Sur, Blk 16	2-12-49	4240	4229- 4239	Strawn sd; Penn	P 142	40
Archer.....	.....	Tom B. Medders' Mrs. O. M. Fuller 1-C, 330 fr e&sl Sect 12, Blk 1, H&TC Sur, 7½ mi s Wichita Falls, se of Vogtsberger fld.	2-23-49	4777	4746- 4777	Vogtsberger sd; Penn	F 484; 1/4"	42
Clay.....	"Lazy-B"...	Gulf Oil Corp's Geo. Scaling et al 1-A, 660 fr s&wl ne¼ Sect 19, H&TB Sur, 6 mi w Joy.	2-1 -49	6195	5571- 5696	Bend cgl; Penn	F 1248; 376 wtr; 3/4"	42
Clay.....	.....	Hassie Hunt Tr's Lilyan Chilson 1, 3560 fr el 330 fr sl C. Thompson Sur, 2½ mi nw Joy.	2-10-49	4615	4560- 4575	.....	P 62	42
Cooke.....	.....	E. L. Leslie's R. M. Lawson 1, 150 fr wl 2050 fr nl H. Nail Sur, 1 mi se Hood	2-22-49	1343	1330- 1338	.....	P 72	40
Jack.....	"Cherry-homes"	Russell Maguire's T. H. Cherryhomes 1, 1601 fr nl 467 fr el of mst/ely n&el of D. Crenshaw Sur. 7 mi se Jacksboro.	2-23-49	5206	4743- 4752	Bend cgl; Penn	P 110	41
Wichita....	.....	J. R. Frankel et al's H. C. Preston et al 1, 150 fr sl 4700 fr wl S. Anderson Sur 1½ mi s Burkburnett.	2- 6-49	1797	1320- 1329	.....	P 11	....
Wichita....	.....	Perkins & Cullum's Chilson 1-B, 330 fr n&el Blk 21, Lge 4, Denton CSL, 2 mi se Kempner fld.	2-12-49	4040	4017- 4040	.....	F 384; 2"	43
		TEXAS—District 9 (NORTH)—Oil Field Extensions						
Jack.....	"Cherry-homes"	Russell Maguire et al's T. H. Cherryhome 1-A, 2269 fr wl 2850 fr sl T. Burbridge Sur se extension.	2- 7-49	4712	4692- 4712	Bend cgl; Penn	F 353; 1/2"	43
Young.....	Murray-Caddo	Bishop Oil Co's P. E. Mueller 1, Sect 2374, TE&L Sur east extension...	2- 2-49	4587	3738- 3748	Caddo li; Penn	F 183; 1/4"	41
		WYOMING—New Oil Field						
Hot Springs	Little Sand Draw	Seaboard Oil Co & Husky Ref Co's Government 1, nw ne sw 2-44n-96w..	1-10-49	6119	6099- 6119	Tensleep sd; Penn	F 264; 11/64"	36
		WYOMING—New Oil Pay						
Fremont...	Beaver Creek.	Stanolind O&G Co's Unit 11, cn½ se 10-33n-96w.....	2-28-49	10903	10442-10493	Tensleep sd; Penn	F 474; 11/16"	....

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; ser, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, Pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Controlled *Vertical* Drilling

By WALTER C. MAIN
Vice President, Technical Oil Tool Corporation, Ltd.

LITTLE has been published on the subject of "Vertical" and "Straight Hole Drilling," even though the great majority of wells are supposed to belong in such categories. As a matter of fact, there seems to be some hesitancy in discussing these subjects. This may be due to the commonplace nature of these problems, whereas by comparison directional drilling offers more intriguing aspects.

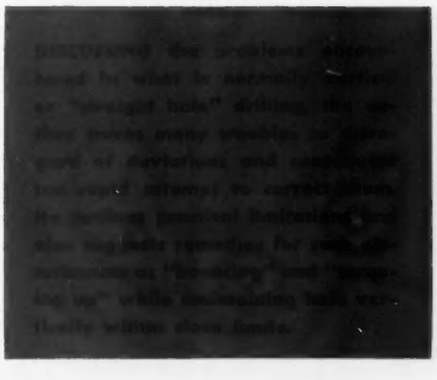
Another and perhaps equally important reason lies in the fact that although everyone takes vertical drilling very much for granted, the attempt to pin down the meaning of vertical or straight hole drilling gets some very evasive answers. For example, in answer to the question, "What do you consider a 'vertical' hole?" the reply invariably begins with the expression "It depends. . . ."

1. Upon locality. Sometimes "it depends" upon the locality. For instance, in Long Beach harbor some holes must lie within a 25-foot cylinder for a short distance and thereafter can deviate as much as 50 feet from under the well head. In many cases the drilling specifications require a limit of three degrees from the vertical, even though a 10,000-foot hole could wander more than 400 feet away, if the average angle were close to three degrees for 8000 feet of the total. In other cases, a vertical hole may have a smaller angle for the major part of its travel and thereafter get off as much as five degrees.

2. Upon property lines and oil structure. Again "it depends" upon whether the well is near a property line or the edge of the oil sand. In these cases, there is a rather wide divergence of opinion. One school of thought insists that as long as the deviation from vertical is in a favorable direction (away from the property line or "up-structure"), an otherwise "vertical" hole may be permitted to go its merry way. The other school of thought insists that it is better to hold the well as truly vertical as possible for two reasons: (1) to finish as close to the property line as possible and sometimes to get valuable data on the exact limits of the oil sand; and (2) because the direction itself is unreliable and frequently spirals away from the expected course and can quickly cross a property line or miss an oil sand.

3. Upon well spacing. Another case of "it depends" is where there is wide well spacing, where property lines are not involved. It seems that the only ones who worry about the shape of the hole in this case are the geologists who are attempting to correlate core data.

4. Upon formation. Most frequently the answer relates to the formation. "It depends," they say, upon whether the formations are difficult to drill, lie at high angles, are treacherous, tend to slough, swell, cavitate, dissolve (as salt), and so on.



It is these instances which leave the question completely unanswered. The inference is that each hole is a distinctly different problem, that rules for straightness or verticality cannot be drawn to cover them, but that as each occasion arises the practical limits will be worked out. There is much to justify this position. As a matter of fact, other than some general rules, and the necessity of keeping within property bounds and out of neighboring wells, this is probably the best method of operating.

One of the considerations which is sometimes mentioned but rarely defined is the effect of deviations on the drill stem and producing equipment. This presents the best possibility of establishing some of the "general rules" mentioned above.

Before getting too far into this subject, perhaps it would be best to distinguish between a "straight" hole and a "vertical" one.

A "straight" hole might be defined as one which did not change its vertical angle by more than six minutes in 100 feet, and its lateral angle by more than three degrees per 100 feet. (More about this lateral angle later.) This is not the same as saying one-degree change in vertical angle per 1000 feet because it implies a very gradual change, and the hole would not be classed as "straight" if the entire one-degree change occurred within, say, half of the total 1000 feet.

This sort of hole could not be classed as a "vertical" hole because if these er-

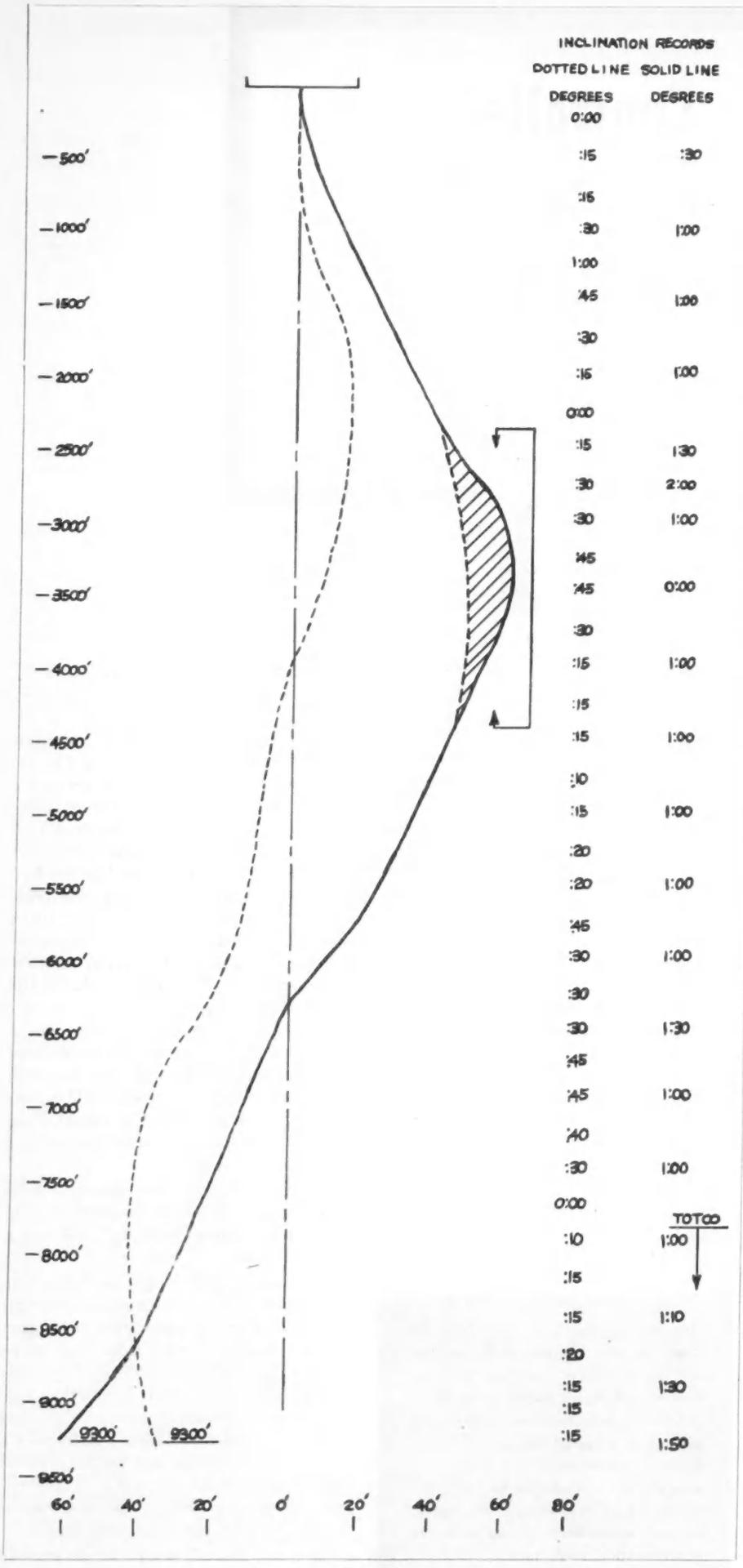


FIGURE 1.

rors were cumulative, the deviation from vertical could reach ten degrees in a 10,000-foot well. However, even with such a high total deviation, the hole would not ordinarily cause trouble. There would be practically no danger of keyseating, tool joint wear would not be excessive, there would be no great stress concentration in the drill pipe, and so on, because at no point would there be anything approaching a sharp change in the path of the bit. It would be a long, sweeping curve with no harm done except that the bottom of the hole might be a couple of locations away from the well head.

To visualize more clearly the meaning of straightness in a drill stem, it might be well to get the proportions definitely in mind, otherwise the above statement about a 10,000-foot hole with a ten degree deviation will not seem reasonable. One 30-foot joint of 4½-inch pipe, taken alone, is a rather sturdy, stiff member, even though it is limber enough to bend a noticeable amount while being handled into and out of the rig. However, consider what 6000 feet of this pipe would look like.

All are familiar with piano wire measuring line. The smaller of the two popular sizes is .072 inches in diameter. Imagine the derrick man lowering such a line from his station to the derrick floor, with a foot-long section of ¼-inch round steel rod on the bottom of it. If you could see 6000 feet of 4½-inch drill pipe all at one time, it would look very much like this tiny wire. A stiff breeze would cause it to foul in the cross-members of the rig. Now think of the same wire inside a small tube through which the ¼-inch rod will just pass. If the lower end of this tube were moved to the nearest corner of the derrick floor, it would cause more than a ten-degree deviation at the lower end. If the tube were straight to begin with, it would assume a smooth curve. As far as it would be possible to detect, there would be no more restriction to movement of the wire than if it were perfectly straight.

Definition of "Vertical" Hole

To define a "vertical" hole is not easy, as mentioned before, but for the purpose of this discussion, assume that a "vertical" hole is one which does not deviate at any point more than two degrees from the vertical, and does not wander more than 75 feet from the vertical center line of the well. It can be shown that such wells would not necessarily be classed as "straight" holes. For example, two offset wells in South Louisiana are illustrated in Figure 1. This shows that troublesome and costly key-seating can occur even when angles are relatively low, and that through careful application of accurate angle recordings and proper methods this condition can be avoided. The wells were drilled by dif-

ferent contractors, but the equipment, such as drill pipe, size and length of drill collars, pumps and boilers, was similar. In the well represented by the solid line curve, slope testing was used. The maximum angle recorded was only two degrees but, after straightening up, a secondary axis was established between 3500 and 3600 feet. Inclination then worked up to one degree and continued at one degree and higher to completion. By the time the well reached 7000 feet, there was evidence of key-seating. The pipe gave trouble going into and coming out of the hole. Finally it stuck, admittedly in the key seat. A six-day fishing job ensued. The other well, indicated by a dotted line, shows a similar curve, due to the similarity of the formations encountered; however, the angles were broken before any considerable departure could accumulate.

Making allowance for the six days lost in fishing in the first of these offset wells, the second well still required three days less drilling time. Also, only 27 bits were used as compared with 34 in the first hole. Finally, although 13 more records were taken with the angle indicator in the second well, the process consumed two hours less running time.

How Fast Can Angle Be Changed?

The problem is how rapidly the angle can be changed safely. In the above example, it will be noted that the well which gave trouble began to get out of hand at approximately 2500 feet. During the next 300 feet, it deviated at the rate of ten minutes per 100 feet. This was not too serious from the standpoint of damage to the drill stem. The big mistake was in straightening up too rapidly, because in the next 200 feet, approximately, the angle had changed (downward this time) at the rate of 30 minutes per 100 feet and for the next 1000 feet the rate of change was around 20 minutes per 100 feet, a total change of three degrees in 1200 feet.

All are familiar with directional drilling jobs where the rate of change of angel was this great or greater, at the time the well was "picking up" angle. The difference in these cases is that such a procedure is recognized as hazardous and much more care is taken in subsequent drilling, and the deviation is all in one direction and not a reverse curve. Even with all of this added care, directional wells with angles as sharp as this give trouble and it is far safer not to exceed one degree in vertical angle in 400 feet.

1. To avoid key-seating. The governing factor in key-seating is the side thrust on the hole by the drill pipe, and the type of formation found at the bend. Changes in angle near the top of a hole, resulting in considerable weight of pipe being suspended beyond the bend, are far more serious than kinks near the bottom, from a standpoint of key-seating. It would appear then that the maximum rate of change of angle to avoid key-seating is around ten minutes per 100 feet in the upper half of a well not over 10,000 feet deep, and 15 minutes per 100 feet in the lower half. This is a recommendation for straightness. Another problem is how nearly vertical the hole should be.

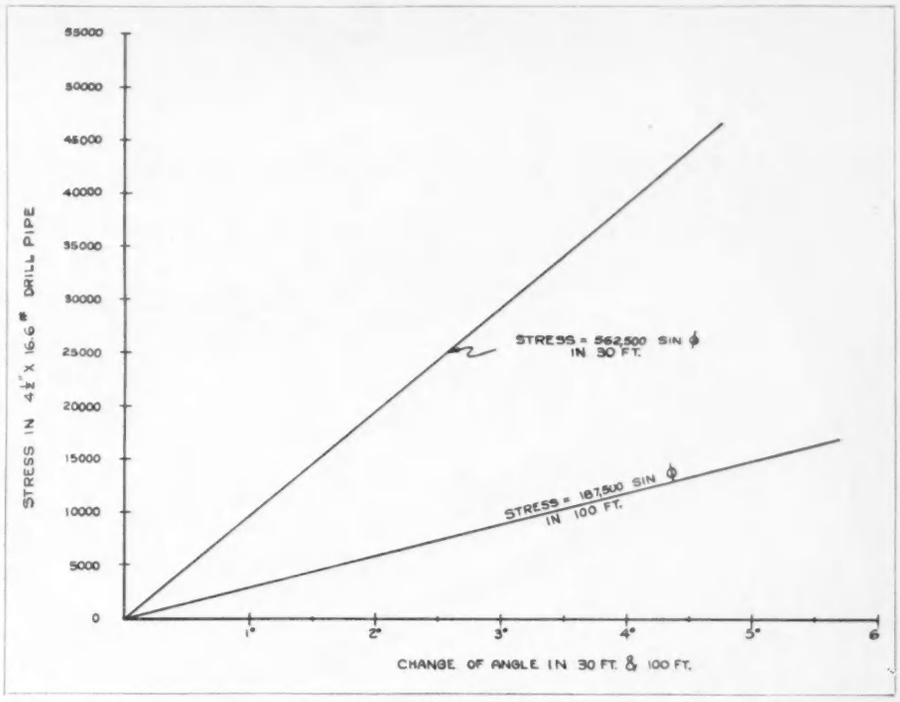


FIGURE 2.

2. To Avoid Overstressing Pipe. The ordinary sizes of drill pipe can be bent safely to a far greater angle than it is practical to drill, before the bending stresses alone reach a dangerous magnitude. Figure 2 illustrates the relation of stress to angle of bend in (1) a 30-foot length of pipe; and (2) a 100-foot length. It will be noted that the bend can be more than 3½ dregrees in 30 feet before the strees reaches a magnitude of 35,000 pounds per square inch. In actual drilling practice, however, there are other stresses in addition to bending stresses which may increase the total stress to a hazardous point. These additional stresses are caused by (1) the weight of drill collars and pipe suspended on the joint; (2) the torque being transmitted through the pipe; and (3) the compressive stress waves resulting from vertical impluses at the bit. These compressive waves can cause "bouncing," if allowed to get out of hand.

Occasionally another type of shock wave is impressed on the pipe by the bit sticking. This happens in a long string when the bit hangs up but the rotary table continues to turn, winding the entire string of pipe up like a spring. When the length of this spring shortens sufficiently to release the bit, it will rotate at a terrific speed until, as the pipe lengthens out again with the twist going out of it, the bit again hits bottom and hangs up again. This action is indicated at the surface by a galloping motion of the table, but this seldom reflects the severity of the action at the bottom of the hole. The point is that most of these other stresses caused by the suspended weight, torque, and so on cannot readily be avoided, whereas the bending stress can be kept at a minimum, if the hole is kept straight, and these shock loads (including "bouncing") can be reduced by careful attention.

There might be a great deal of criticism of anyone who advocated, as a matter of drilling efficiency, that the hole be kept vertical within one degree at all points and three degrees per 100 feet laterally, and yet there do appear to be grounds for such a recommendation. We have all known of wells which were within these limits, and we remember that drilling records were broken and in most cases freedom from troubles resulted. The limit of angle-change, of ten minutes per 100 feet in the upper half of the hole, and 15 minutes per 100 feet in the lower half would also apply.

3. From drill collar considerations. The prevailing tendency in drill collar selection seems to be toward large collars—that is, larger in proportion to the bit size. It is not uncommon to find 7¾-inch outside diameter collars being run in a 9⅝-inch hole, on 4½-inch drill pipe, with what would appear to be a very small margin for "wash-over" purposes. In fact, some operators do not seem to worry about seven-inch collars in an 8⅝-inch hole, an even smaller margin. A string of such collars over 100 feet long cannot be bent nearly so far as the drill

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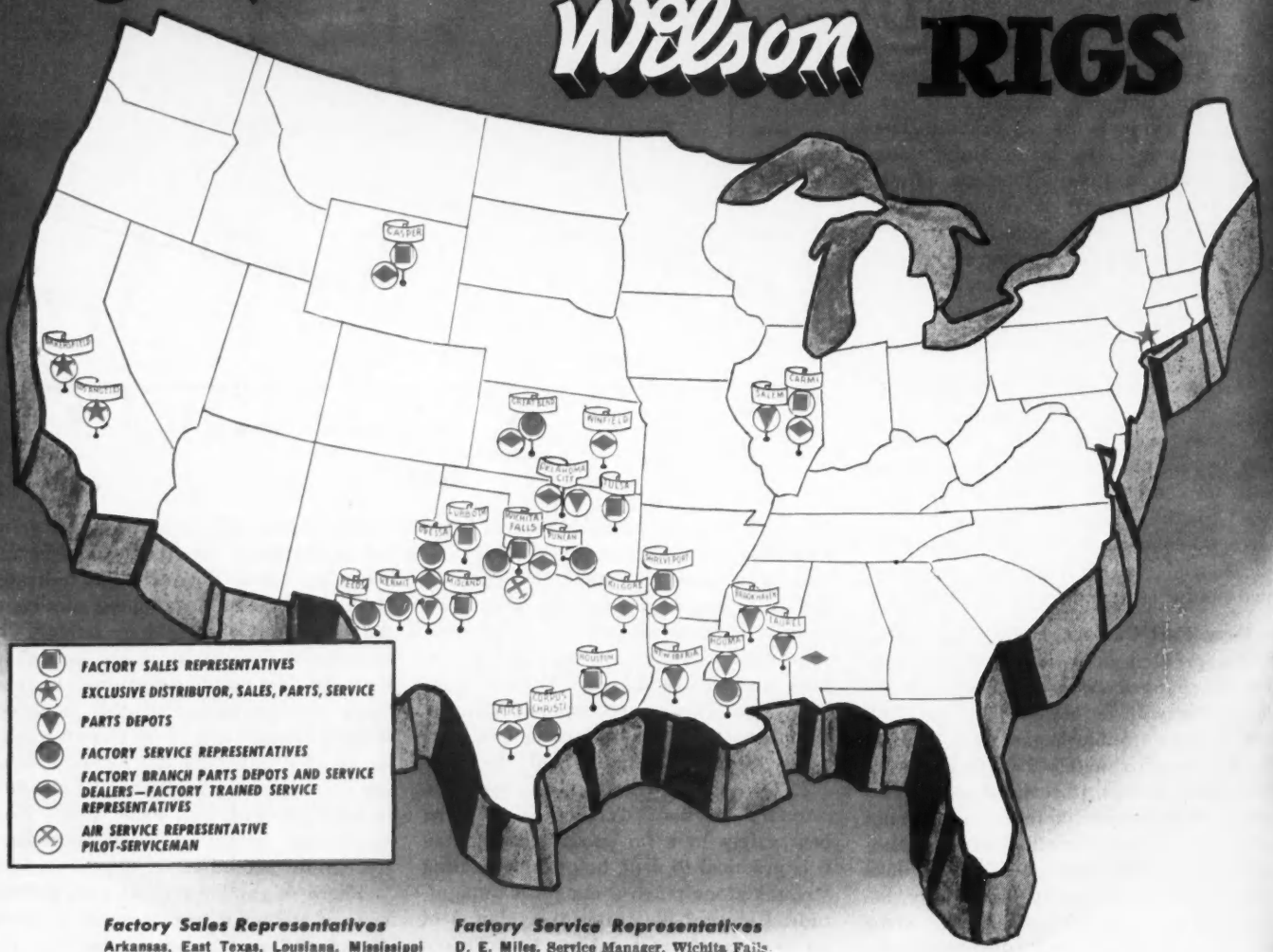

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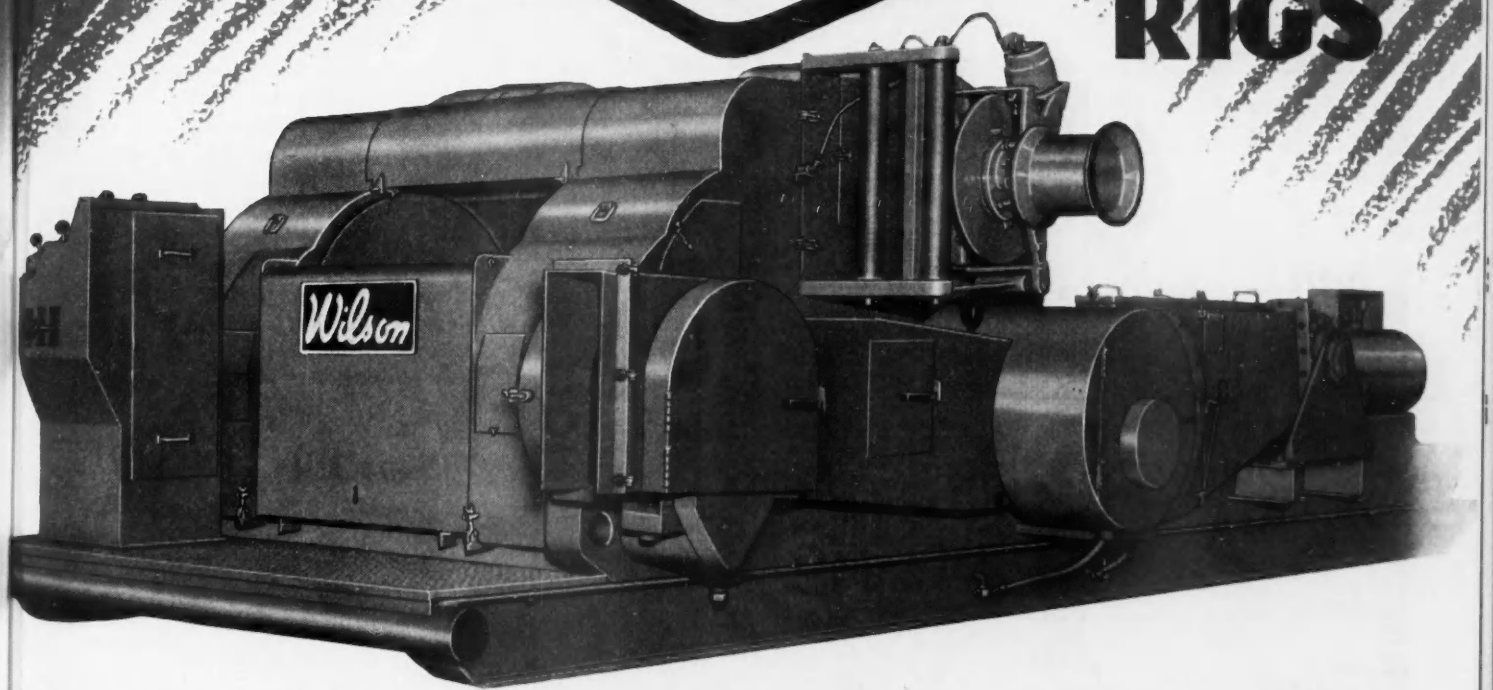

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pipe mentioned above, without damaging it. Everything which has been said about stresses in the drill pipe in the preceding section applies in a more aggravated way to drill collars.

However, the most serious effect is on the drill collar joints. The tool joints on the drill pipe are sturdier and heavier than the pipe, so they transfer the stresses to the pipe in such a way that the pipe ends are more heavily stressed than the joints. In the case of the drill collars, the joints are the weakest spots in the string, with most of the stresses concentrated in the threaded portion. This is another reason for keeping the total angle and the rate of change of that angle to the figures mentioned above.

There have been a few claims made that a perfectly straight hole is hard on drill pipe. The facts are that the straight hole itself is not responsible for the trouble but rather that with a straight hole there is less damping of the resonant vibrations in the pipe which, if allowed to build up, will cause the pipe to "bounce" and "torque up" to an astounding degree. These bad conditions are so easy to avoid that it is rather surprising there has not been more said on the subject. Here, in short, is the way this problem shapes up:

1. The drill stem acts as a spring-pendulum. Any lengthwise impulses, such as are caused at each revolution of the bit by the irregular shape of the bottom of hole, which occur at the natural frequency of the drill stem will cause it to "bounce." The curved lines in Figure 3 show what the three principal frequencies are for strings of drill pipe up to 10,000 feet in length. This action is practically independent of the size, weight, and range of pipe.

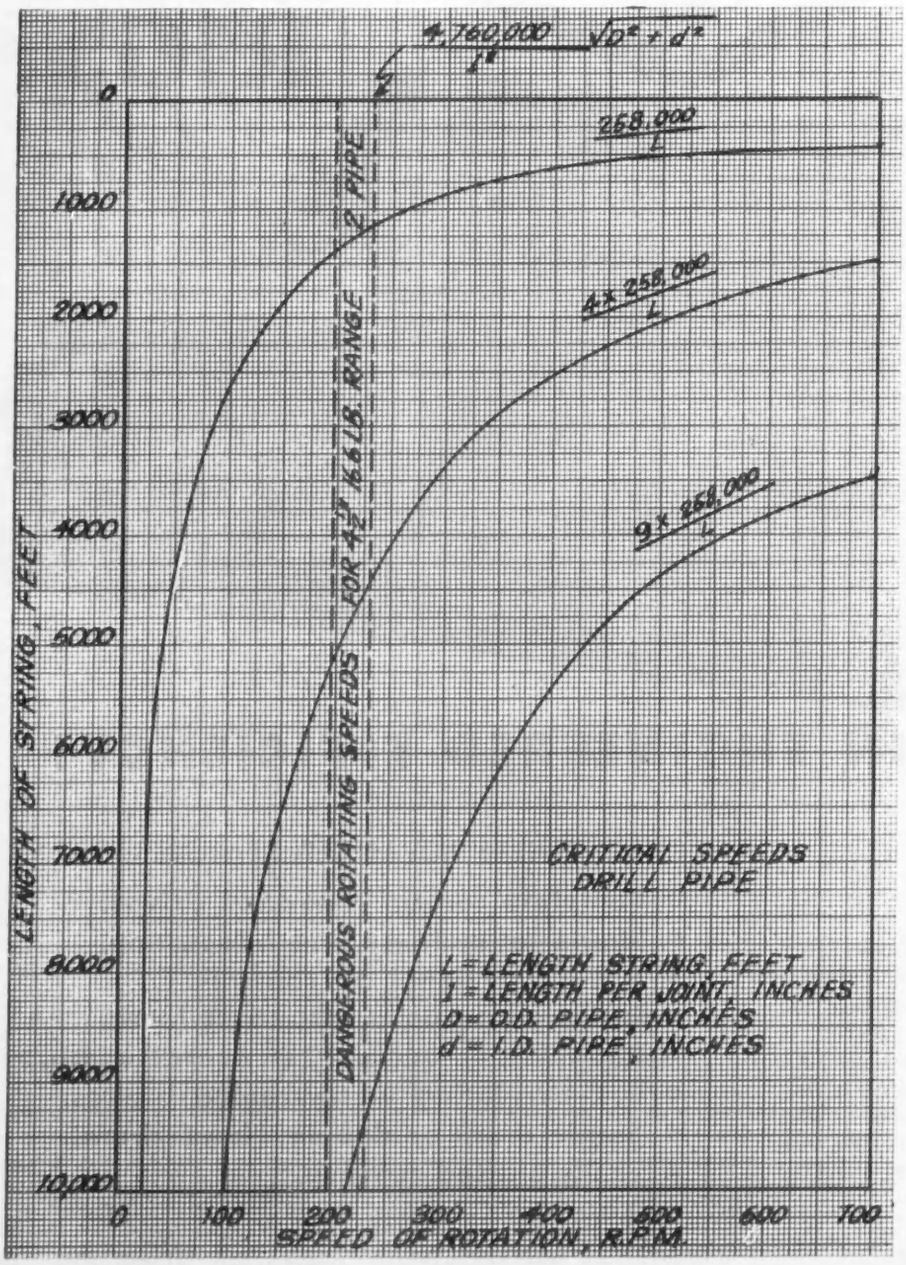

FIGURE 3.

2. Each joint (or double) of pipe tends to swing as a "node" and the natural period of 4½-inch x 16.6-pound drill pipe is shown graphically in Figure 3 as an area between the two dotted lines. The reason this is an area instead of a line is that the diameter, thickness and length of the individual joints vary to a limited extent.

All the driller has to do is to avoid those speeds which cause the resonant conditions and particularly those speeds which result in both resonant conditions at the same time. If he does not have these curves, he can readily find the important one by locating the speed at which the pipe will "torque up." This can be done by raising the bit just off bottom and increasing the speed rather slowly but as steadily as he possibly can. At some speed, the torque gauge will continue to rise as he opens the throttle but the tachometer will not continue to rise and in many cases will slow down. This is the speed he should avoid —at that depth. The best speeds are probably above that speed and it is not difficult, as a rule, to get the table rotating steadily below these critical speeds and then rapidly open the throttle and pass these resonant speeds without allowing the bouncing action time to generate.

Heavy, viscous mud will affect these critical speeds somewhat but as mentioned above, they can easily be checked and the driller will soon find he can make more hole with far less grief if he never lets the pipe "bounce" or "torque up."

High Speeds and Reamers

It is probable that higher speeds (e.g. around 400 or 500 rpm) will produce straighter hole than slower ones. We realize that high rotational speeds tend to heat up the bearings in any bit having rotating cones or other types of cutters. We also realize that these bearings are not too well lubricated and that drilling mud is often not a good lubricant. All that can be done to help this situation is to keep the mud as cool as possible; keep the viscosity down, and pump it at as fast a rate as practical. The bit problem itself is too big a subject for this paper. We are confident that the bit manufacturers can solve it, if there is need for anything special for higher rotational speeds.

It is also probable that the use of reamers located in the intermediate sections of the drill collar string will also assist in keeping the hole straight. Some careful thought must be given when using these reamers, on the amount of weight they will support, and additional drill collars should be added to supply that weight. Otherwise, the situation might be aggravated rather than helped,

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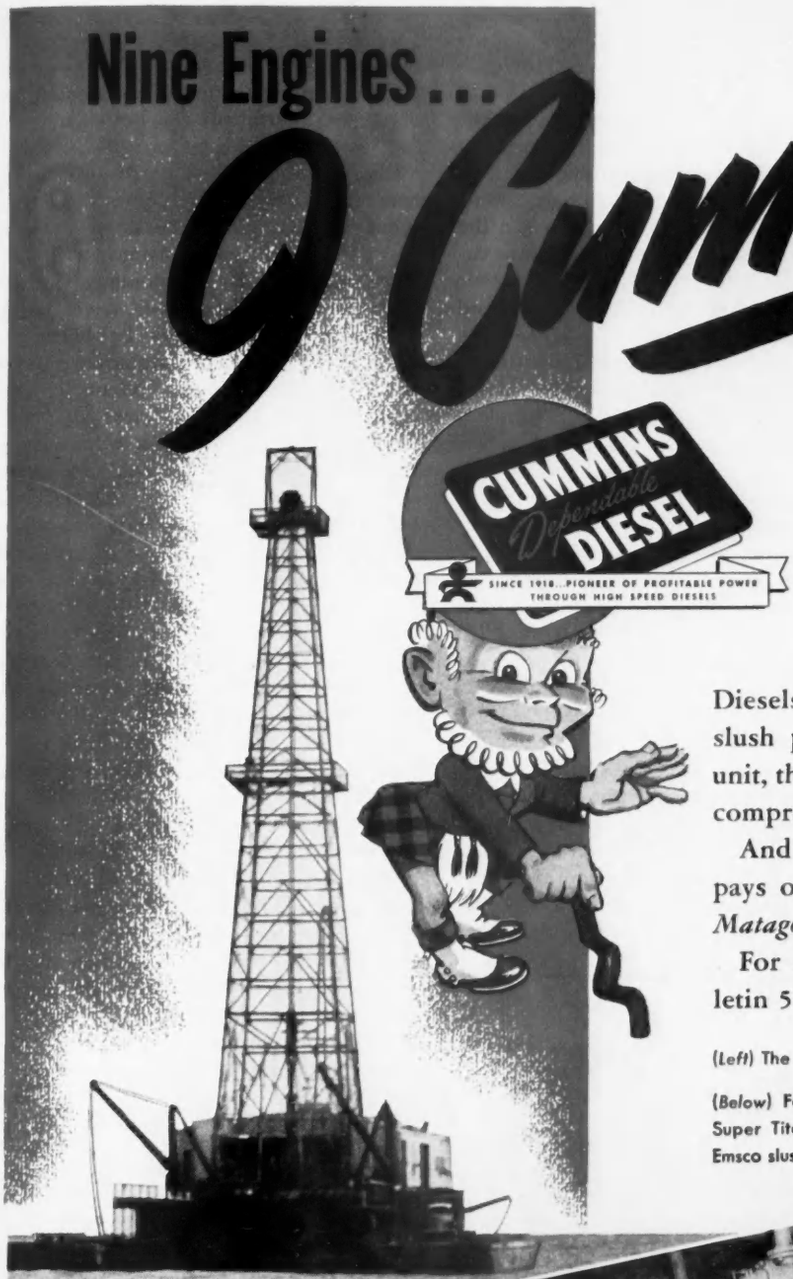

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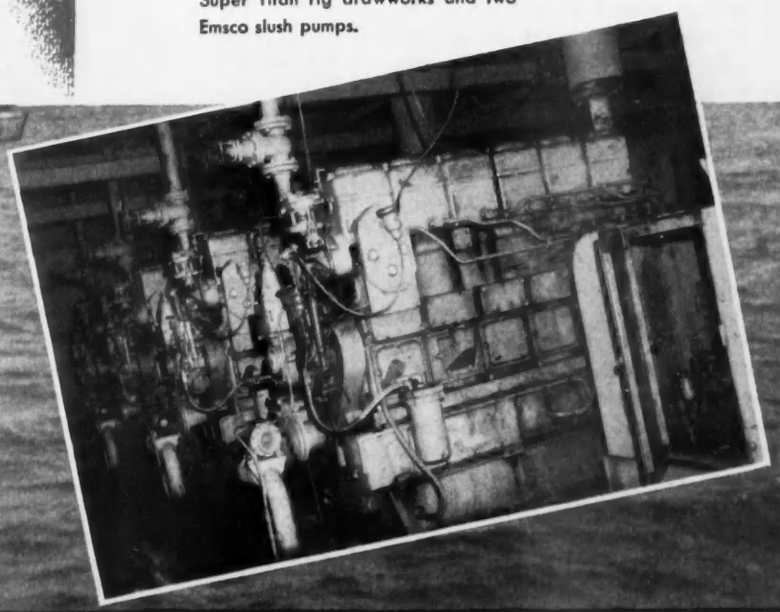

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because some of the drill pipe may be under compression.

How is this "straight hole" problem affected by "spiraling?" It is probably true that in the upper part of a drilled hole, a spiral path is most common and in the lower part of the hole (beyond 4000 feet) the direction will frequently remain more constant.

From a standpoint of staying under the rig floor, within property bounds and on the proper track to hit the formation, this spiraling tendency is an advantage. But from a standpoint of damaging the drill pipe, it is worse than if the deviation from vertical were all in the same direction. Pipe will "torque up" more quickly and severely in a spiral hole and "bouncing" in the lower portions may become very severe without too much evidence of this fatiguing action reaching the surface. Cases have been known where, after removal from the hole, it was obvious that a 4000-foot section of pipe at the bottom of 10,000-foot string of pipe had been beating itself to pieces without any noticeable clatter at the table. These instances always occurred where there was a tight spiral for 1000 to 3000 feet below the surface pipe.

It is also true that key-seating can occur more easily in a spiral hole than in one where the compass direction is more constant.

Because of these hard-to-measure effects of lateral angle changes, it is difficult to set any logical limit on the rate of change of this angle, except to point out that five degrees per 100 feet will result in bending stresses alone which would be high enough so that any of the added stresses would result in a total that would exceed safe working value.

The maximum torque does not occur when the table is rotating smoothly but, as mentioned before, when there is a tendency to stall. This problem of "torquing up" which results in slowing down or even stalling a sizable drilling engine should be discussed a bit more thoroughly, even though the stresses from this cause alone are usually not of extremely high magnitude. This does not mean that they are not important because, when added to other stresses, the total may build up very rapidly.

The stresses in torque are greatest with steam engine drivers, with D. C. motors next, with diesel engines third, and with gas engines last.

If one were to calculate the torsional deflection which would result from actually stalling a 125 horsepower engine or electric motor by snagging the bit, it would be found that there would be many complete revolutions of the table after the bit stopped before the table came to a full stop.

As mentioned earlier, this twisting action in itself tends to shorten the string and raise the bit, often enough to relieve the "snagged" condition. However torsional impact resulting from the snagging and release may be severe.

This is a bit afield from the problem of controlled vertical drilling but, as mentioned above, the straighter the hole, the lower the torque required to spin the pipe, except when critical speeds are encountered. When these critical speeds are not avoided, "all bets are off" and much damage may be done to the pipe.

While it is true that the old acid-bottle type of deviation measurements are not accurate enough, most of the modern survey instruments can be read to the nearest ten minutes without the aid of a magnifier. With a good glass (and some experience), is is possible to judge the angle to half of this limit. However, it often happens that the instrument is more accurate than the method of running it. Where the instrument case (or go-devil) is not known to lie precisely parallel with the axis of the hole-bore, readings which are made to less than ten minutes may have little meaning.

It is obvious, we think, that the drill string, and particularly the drill collars, will assume a position more nearly parallel to the axis of the well-bore, than will a smaller (and shorter) barrel lowered into the open hole on a wire line. It follows, therefore, that readings taken inside the drill string are to be preferred. This applies to directional readings also, even though it is necessary to provide a non-magnetic section of drill collar in which the instrument can be brought to rest, just above the bit.

Even under the best conditions, however, it is very desirable to take frequent readings and to check those which are not perfectly consistent with all other readings. By so doing, the true course of the well-bore will never be in doubt. It should always be borne in mind that a series of measurements of any kind vary to some extent. If you were to measure the thickness of a very flat uniform plate with a micrometer, you would get a series of readings which would vary and it would not be considered bad practice if you averaged those readings and announced a definite figure as the actual thickness of the plate. In the same way, if the deviation readings in a well-bore ran as follows:

Depth	Deviation (in degrees and minutes)
2200 feet	1° 20′
2300 feet	1° 30′
2400 feet	1° 20′
2500 feet	1° 25′
2600 feet	1° 20′
2700 feet	1° 40′
2800 feet	1° 30′

it would not be at all in error to assume that the one-degree, 40-minute reading was due to the position of the go-devil rather than a 20-minute change in actual hole direction, and that the actual deviation was very close to one degree 25 minutes for the entire 600 feet involved, and did not actually change over five minutes in any 100 feet.

Conclusions

Controlled vertical drilling often can be made as interesting as controlled directional drilling, without involving nearly so many hazards.

Straight holes should not vary more than six to ten minutes in vertical angle in any 100-foot section.

Except for considerations involving property or oil structure limits, straight holes are of more importance than vertical ones (which never exceed two or three degrees from a truly vertical direction). Care should be used to prevent too rapid "straightening."

Straight holes need not be more severe on drill pipe than slightly crooked ones, provided proper care is used in the selection of drilling speeds and weights.

Instruments are available which are sufficiently sensitive and accurate so that credible readings may be taken to the nearest five minutes.

Finally, the best practice indicates taking frequent readings, checking those which are not consistent, and using ordinary good judgment in interpreting the readings obtained.

About the Author

WALTER C. MAIN was born in Ohio and started his college career at the Case School of Applied Science. World War I interrupted his studies which later were completed in the Engineering School of the University of Michigan. Between wars he was employed by the Elyria Iron and Steel Company, now the Steel and Tube Division of the Republic Steel Company, the Carnegie Steel Company, Standard Oil Company of California, and Youngstown Sheet and Tube Company. He served nearly five years in World War II, after which he joined Technical Oil Tool Corporation, Ltd., of which he is vice president.

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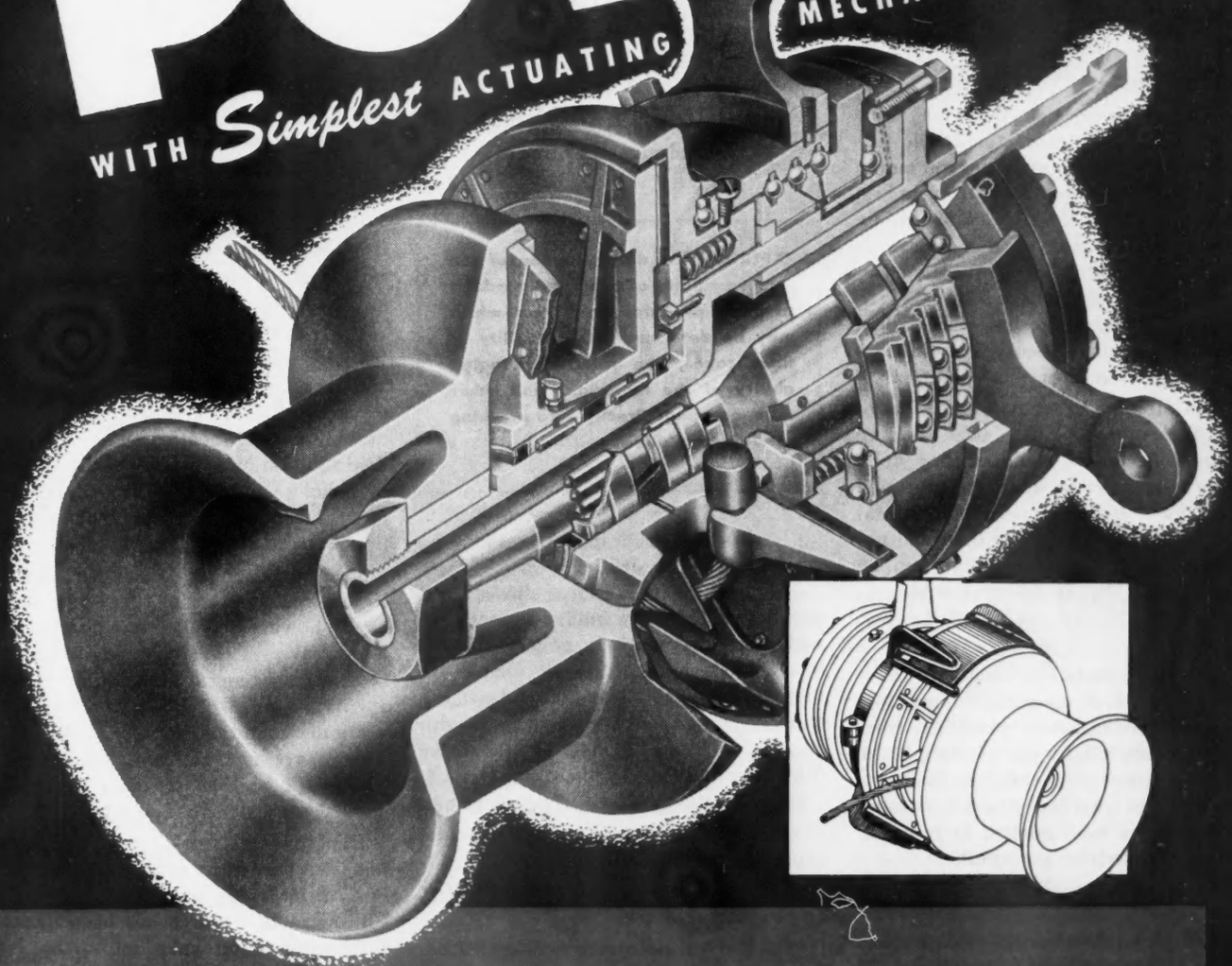

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Compressibility of Bulk Agents Used to Combat Lost Circulation

By JAMES I. MORRIS,
Petroleum Engineer

EXPERIMENTAL determination of the compressibility of bulk agents added to muds provides data from which may be determined the stability of filter cakes, the relative plugging ability of the materials, and other data entering directly into working conditions at the rig.

ONE of the serious problems to be overcome in drilling practice is the loss of fluid to "thief" formations, commonly called lost circulation. This problem first appeared early in the history of drilling and the introduction of the rotary rig greatly accentuated it. The drilling industry spends millions of dollars annually in combating lost circulation, while numerous expensive wells are abandoned because of this condition.

In an attempt to overcome this problem, the industry has been adding fibrous bulk agents to the drilling fluid, on the theory that these agents will form a basic structure resembling a mat and that the colloids in the mud will use this mat as a base for setting up an impermeable sheath which would perform the function of sealing off the thief formations.

This article deals specifically with experiments to determine the volume loss of fibrous bulk agents resulting from pressures exerted by the drilling fluid. The fluid pressure is equal to the pressure of the overburden plus the pressure applied at the mud pumps. It is calculated by the following formula:

$$P_t = p + 0.434 \times d \times D$$

in which

P_t = the total pressure in pounds per square inch exerted by the drilling fluid.

p = the pressure in pounds per square inch exerted at the mud pumps.

d = the density of the drilling fluid relative to water.

D = the depth in feet at which the bit is drilling.

The addition of various fibrous bulk agents to the drilling fluids has met with varied results, which in general are far from satisfactory. Research relative to these fibrous bulk agents has been extremely limited and has been made with specific reference to the depth of the filter cake built up by these materials.

Field studies have determined that loss of circulation is caused by three distinct subsurface conditions:

1. Loss of drilling fluid into fissures, cracks, and crevices.
   a. Natural occurring geological conditions.
   b. Horizontal fissures in the bedding planes between formations. These fissures are caused by the pressure exerted by the drilling fluid.
2. Losses into caverns.
   a. Caverns having volumes of minor magnitude.
   b. Caverns having excessively large volumes.
3. Losses into porous highly permeable formations of sandstone, limestone, shale, gypsum, etc.

When a thief formation has values of porosity ranging from 20 to 50 percent; and values of permeability ranging from three to 10 darcies, losses cited in Condition 3 may in most cases be negligible. The addition of 3 to 5 percent by volume of colloid material to the drilling fluid overcomes the condition. The application is termed mud conditioning.

Mud conditioning has shown very desirable results for the range previously cited; however, the remaining types of losses have yet to be prevented or alleviated, and in general the addition of bulk agents has been used in efforts to overcome the condition. Almost all materials which have fibrous characteristics have been used and those most commonly applied are listed in Table 1.

Experimental work with bulk agents has been limited to two aspects: building of a filter cake, and plugging ability. Considerable research has been directed toward the filter cake set up by bulk agents. The basic principle is that of a filter press. A mixture of bulk agent and drilling fluid is introduced into a mixture chamber. A plunger activated by hydraulic pressure forces the mixture into a

TABLE 1

Majority of Fibrous Materials Used in Combatting Loss of Circulation.

1. Cottonseed Hulls	13. Bagasse
2. Bales of Cotton	14. Beans
3. Beet Pulp	15. Plastic Materials
4. Rope Yarn	16. Shredded Cloth
5. Manure	17. Lime
6. Sage Brush	18. Waste Lead Wool
7. Cellophane	19. Straw
8. Processed Tree Bark	20. Sawdust
9. Peas	21. Peat Moss
10. Rice	22. Feathers
11. Asphalt	23. Prairie Hay
12. Cement	24. Beet Tops

TABLE 2

Specifications of Experimental Testing Apparatus.

PART	No.	Length, Inches	Inside Diameter, Inches	Outside Diameter, Inches	Volume Inches Cubed
Pressure Cylinder	1	10.000	1.500	4.000	....
Cylinder Plate	1	1.000	1.500	6.000	....
Pressure Plunger	1	6.000	1.500	....	....
Steel Tubing	1	69.000	0.069	0.125	....
Mixture Chamber	1	25.000	1.000	2.000	27.44
Caps for Mixture Chamber	2	2.500	2.000	2.500	....
Nipple	1	2.000	0.125	0.500	....
Bull Plug	1	1.000	....	0.500	....
Busring	2	1.250	0.125	0.500	....
Needle Valve	1	....	....	0.500	....
Rubber Plugs	2	1.000	....	1.500	....

Titus Olsen Testing Machine—50,000 pound load capacity.

pressure cylinder. Contained in this cylinder is some type of rock formation. From this experiment, the following factors can be studied:

1. The visible characteristics of the plaster built up by the drilling fluid and bulk agent.
2. The thickness of the plaster.
3. The filtration through the plaster, measured in milliliters per minute.
4. The depth of penetration of the plaster into the formation.

The second application has been to determine the plugging ability of the various bulk agents. A mixture of bulk agent and drilling fluid is pumped into a cylinder containing a rock formation. The pressure built up at the pump is the measure of the plugging ability.

Previous research, however, has been concerned solely with surface conditions. This study will attempt to determine compressibility factors for bulk agents. Through these factors, subsurface conditions can be simulated with surface testing equipment.

As already indicated, previous research has been concerned solely with reactions of bulk agents at the surface. Using surface testing equipment an attempt was made to simulate subsurface conditions and thereby study the reactions of bulk agents after their introduction into a bore hole.

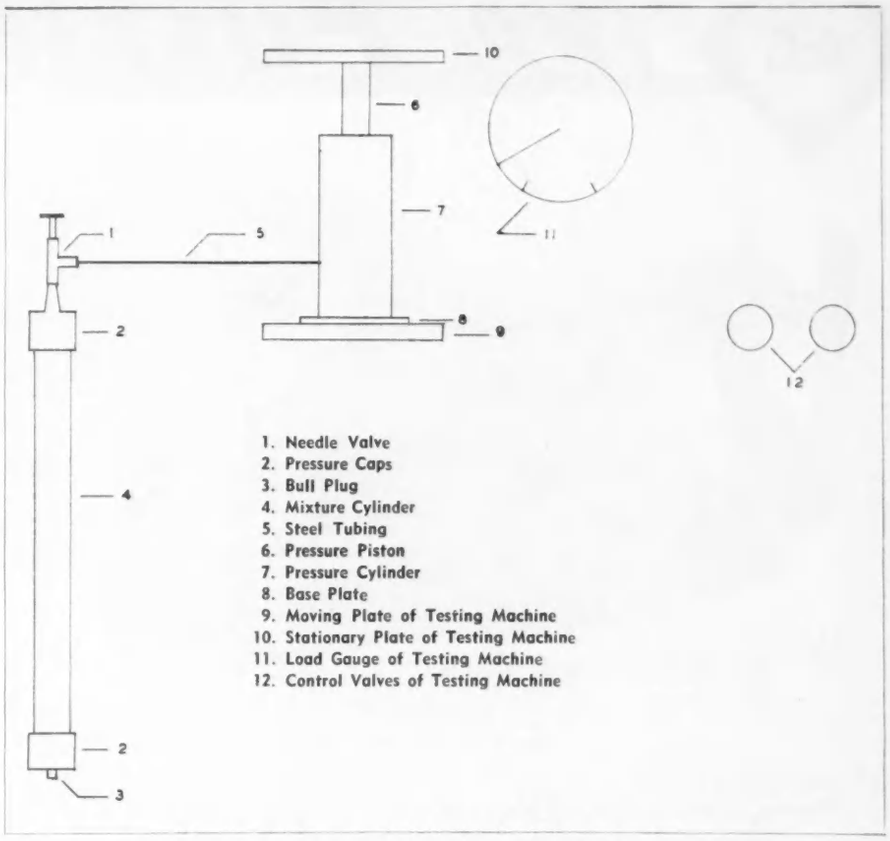

FIGURE 1. Diagrammatic drawing of experimental testing apparatus.

Method of Procedure

At the inception of these experiments it was found that no standard method existed for determining compressibility for bulk agents, because high compressibility factors could not be determined from the dry materials. Also it was desired to simulate field conditions by having the bulk agents suspended in various drilling fluids. With these points in mind, the theory of fluid displacement was decided upon as the basic principle to be employed in the experimental research.

The specifications of the apparatus used in the experiments are tabulated in Table 2. The apparatus consisted of three major parts; a hydraulic pressure cylinder was placed between the load plates of the testing machine. Load was applied to the hydraulic cylinder by placing the testing machine in compression. The two cylinders were connected by a length of coiled steel tubing. Hydraulic fluid was forced from the hydraulic cylinder through the tubing into the mixture cylinder. As this cylinder was filled with a mixture of drilling fluid and bulk agent, compressibility resulted from the addition of the hydraulic fluid. Compressibility was measured in volume change by noting the decrease in length of the plunger at a variety of loads. Lengths on the plunger were measured by a set of inside micrometers. A diagrammatic drawing of the apparatus is shown in Figure 1.

For the sake of accuracy each weighted portion of bulk agent suspended in a given weight drilling fluid was submitted to three runs. Alternate readings of pressure were taken for each run at 1500-pound load increments in all cases. For a given load the consequent length of the plunger was measured and these data recorded. After each run, the successive smaller lengths were subtracted from the length reading taken at a zero load reading. This operation gave a dependent function of the value of compressibility. The value was first expressed in terms of the depression of the plunger

TABLE 3
Physical Characteristics of Bulk Agents Tested.

CHARACTERISTIC	BULK AGENT						
	A	B	C	D	E	F	G
Appearance	Shredded Cellophane Strips	Exploded Plastic	Prairie Hay	Processed Redwook Bark	Feathers	Cottonseed Hulls	Cut Cellophane
Density	0.445	0.287	0.1470	0.1786	0.1777	0.500	0.400
Specific Gravity	0.445	0.287	0.1470	0.1786	0.1777	0.500	0.400
Volume in Cubic Feet, per Pound of Bulk Agent	0.0562	0.0361	0.1092	0.0898	0.1363	0.0321	0.0402
Volume in Cubic Centimeters per Gram of Bulk Agent	3.50	2.25	6.80	5.60	8.50	2.00	2.50

TABLE 4
Compressibility Factors in Percent Volume of Bulk Agent Compressed.

Pressure, Psi.	PERCENT VOLUME COMPRESSED						
	A	B	C	D	E	F	G
0000	0	0	0	0	0	0	0
283	34.6	53.3	26.7	31.0	16.8	28.3	44.2
500	38.5	62.6	29.2	33.8	18.4	32.2	50.7
1000	45.2	69.0	31.3	36.1	19.9	36.9	56.3
1500	49.8	72.4	32.8	37.4	20.7	40.4	59.6
2000	52.6	74.6	33.9	38.6	21.4	43.9	62.2
2500	55.9	77.2	35.1	39.7—	22.0	46.9	64.8
3000	57.8	78.7	36.2	40.8	22.7	49.7	67.4
3500	60.0	80.8	37.1	42.0	23.4	52.6	70.1
4000	61.9	82.8	38.4	43.1	24.1	55.1	72.7
4500	64.0	84.8	39.0	44.2	24.8	57.5	75.3
5000	66.0	86.9	39.5	45.3	25.5	59.8	77.9
5500	68.1	88.9	40.1	46.4	26.2	62.2	80.5
6000	70.1	90.4	40.2	47.4	26.9	64.4	83.2

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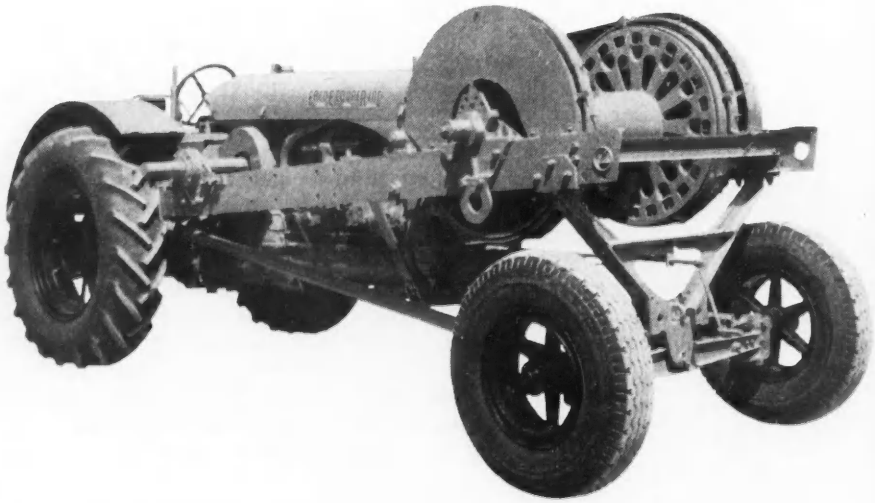
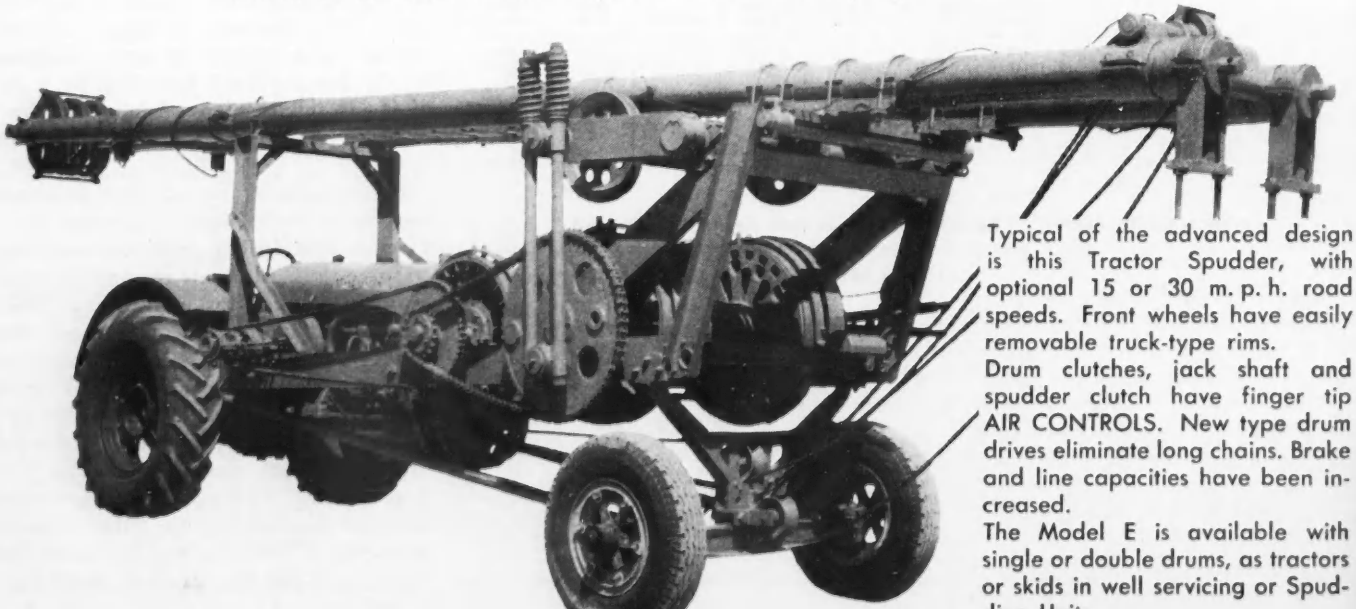


Model E563 Double Drum Spudder with telescoping mast



Typical of the advanced design is this Tractor Spudder, with optional 15 or 30 m. p. h. road speeds. Front wheels have easily removable truck-type rims.

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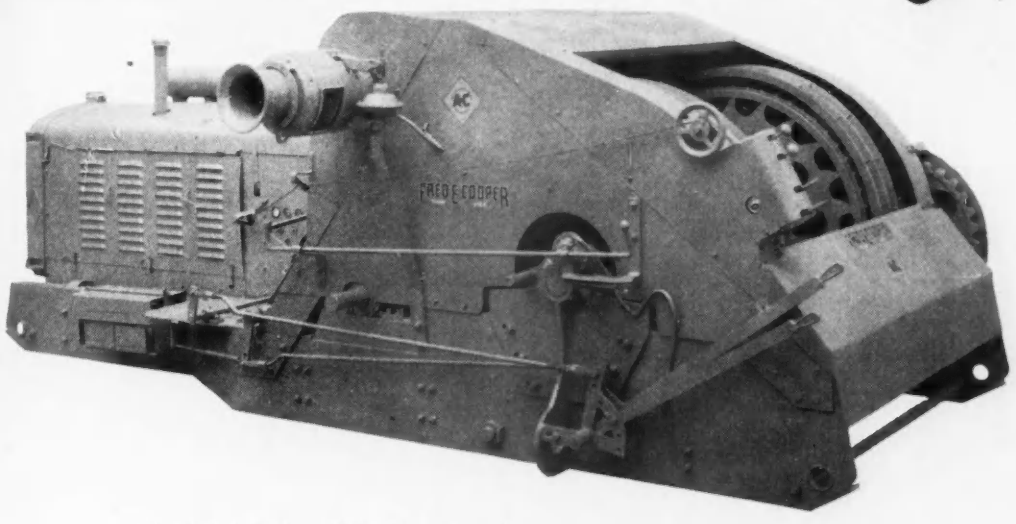
E. to use in '49 for



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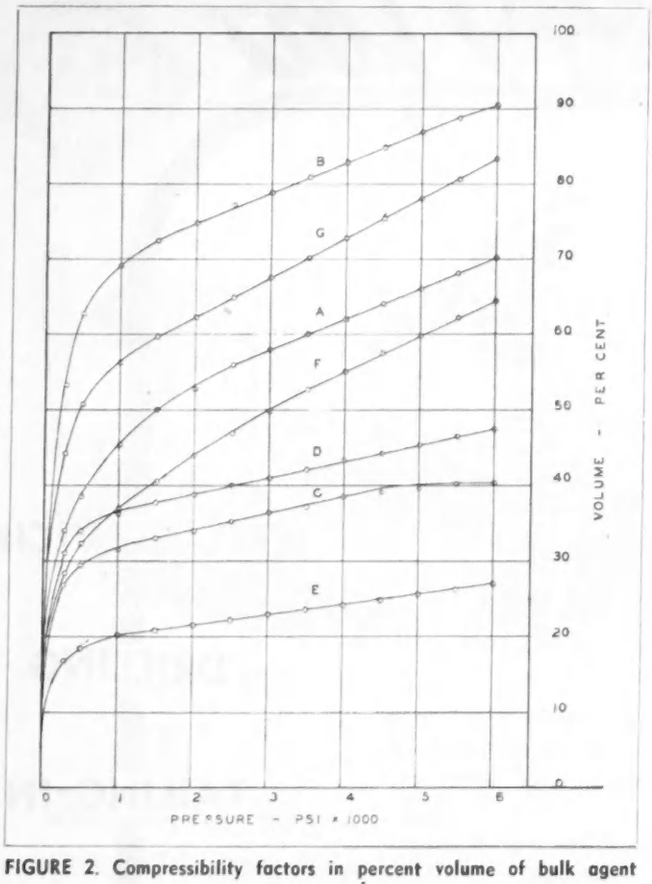

FIGURE 2. Compressibility factors in percent volume of bulk agent compressed.

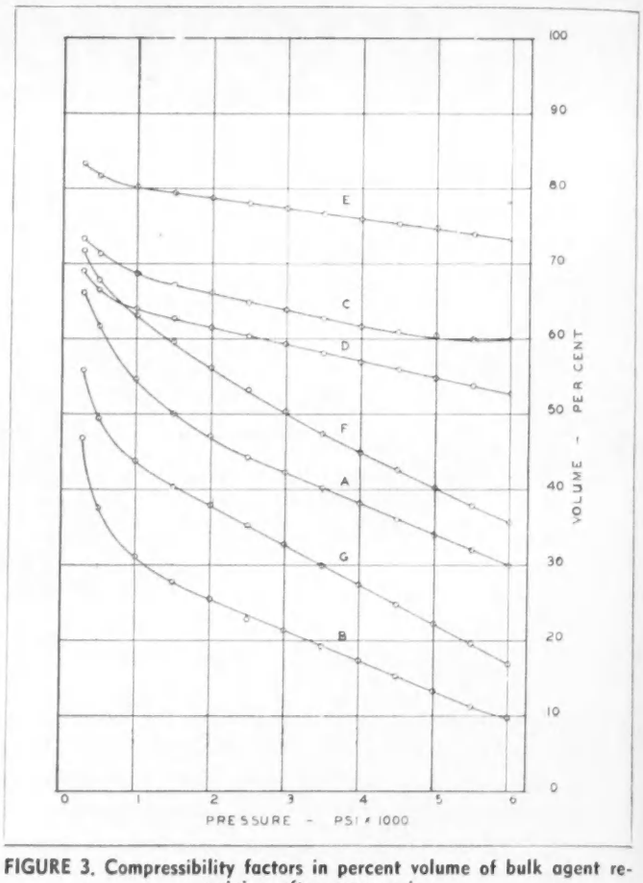

FIGURE 3. Compressibility factors in percent volume of bulk agent remaining after compression.

in inches and calculated from the following formula:

$$D_b = D_t - \frac{V_1}{V_c} \times D_f$$

in which

D_b = depression in inches of the bulk agent.
D_t = depression in inches of the mixture.
V_1 = volume in cubic centimeters of the drilling fluid after the addition of bulk agent.
D_f = depression in inches of the fluid.
V_c = volume in cubic centimeters of mixture cylinder.

Knowing the volume of bulk agent used in each run, the height of a column having a diameter of 1.5 inches was calculated. Compressibility factors for all bulk agents were calculated from the following formula:

$$F_b = \frac{D_b}{H_b} \times 100$$

in which

F_b = compressibility factor in percent volume bulk agent compressed.
D_b = depression in inches of the bulk agent.
H_b = height of column in inches of bulk agent.

Experimental Data

Five of the seven bulk agents tested are marketed by competitive companies. Therefore, each bulk agent was given a letter identity as follows:

1. A — shredded cellophane strips.
2. B — exploded plastics.
3. C — prairie hay.
4. D — processed redwood bark.
5. E — feathers.
6. F — cottonseed hulls.
7. G — cut cellophane.

Data pertaining to the physical characteristics of the bulk agents were not available from the manufacturers. For use in this study apparent density, specific gravity, volume per pound, and volume per gram were determined for each bulk agent. These determinations were all relative to the other measurements used in this experiment and cannot be assumed to be independent. The characteristics are tabulated in Table 3.

Three volumes of bulk agents were used in the experimental study. These were equivalent volumes of 5, 7.5, and 10 pounds of bulk agent per barrel of fluid. The values represent the maximum and minimum used in field practices.

Three weights of drilling fluids were used for each weight of bulk agent. These were 8.33 (water), 9.35, and 12.35 pounds per gallon. This range covers the most used drilling fluid weights found in field practice.

The data for the experimental compressibility factor for a given bulk agent at a given load showed a near constant value. This consistency was present regardless of the volume of bulk agent used or weight of drilling fluid. It should be remembered, however, that there is a definite compressibility factor for every material at any desired load. On the basis of this indication, an average value

TABLE 5

Compressibility Factors in Percent Volume of Bulk Agent Remaining After Compressing.

Pressure, Psi.	PERCENT VOLUME REMAINING						
	A	B	C	D	E	F	G
0	100	100	100	100	100	100	100
283	66.0	46.7	73.3	69.0	83.2	71.7	55.8
500	61.5	37.4	70.8	66.2	81.6	67.8	49.3
1000	54.8	31.0	68.7	63.9	80.1	63.1	43.7
1500	50.2	27.6	67.2	62.6	79.3	59.6	41.4
2000	47.4	25.4	66.1	61.4	78.6	56.1	37.8
2500	44.1	22.8	64.9	60.3	78.0	53.1	35.2
3000	42.2	21.3	63.8	59.2	77.3	50.3	32.6
3500	40.0	19.2	62.9	58.0	76.6	47.4	29.9
4000	36.1	17.2	61.6	56.9	75.9	44.9	27.3
4500	36.0	15.2	61.0	55.8	75.2	42.5	24.7
5000	34.0	13.1	60.5	54.7	74.5	40.2	22.1
5500	31.9	11.1	59.9	53.6	73.8	37.8	19.5
6000	29.9	9.6	59.8	52.6	73.1	35.6	18.8

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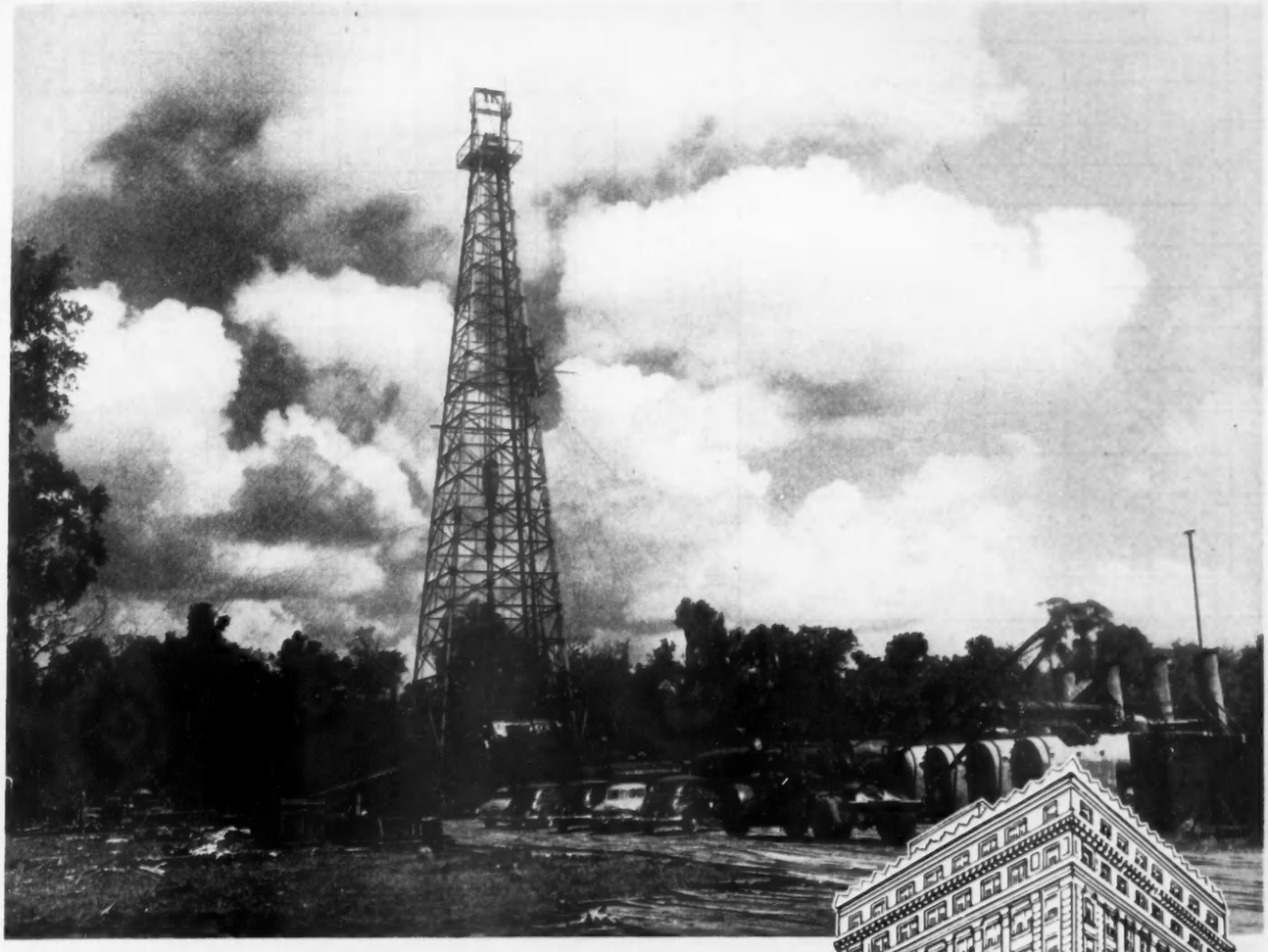

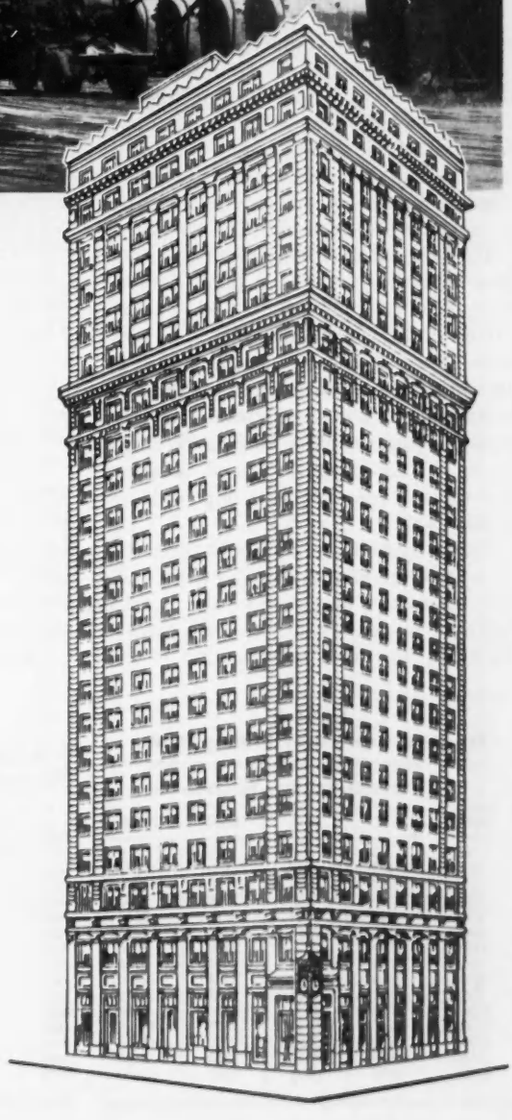

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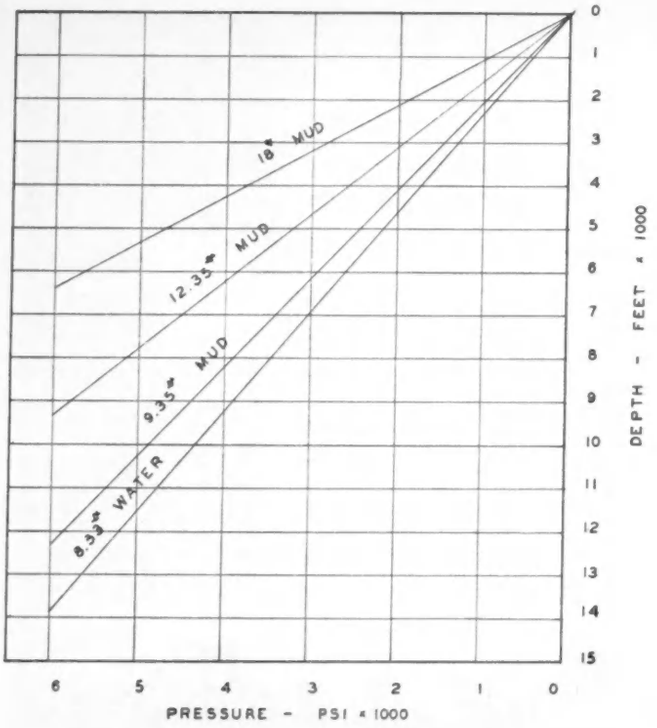

FIGURE 4. Pressures exerted by drilling fluids.

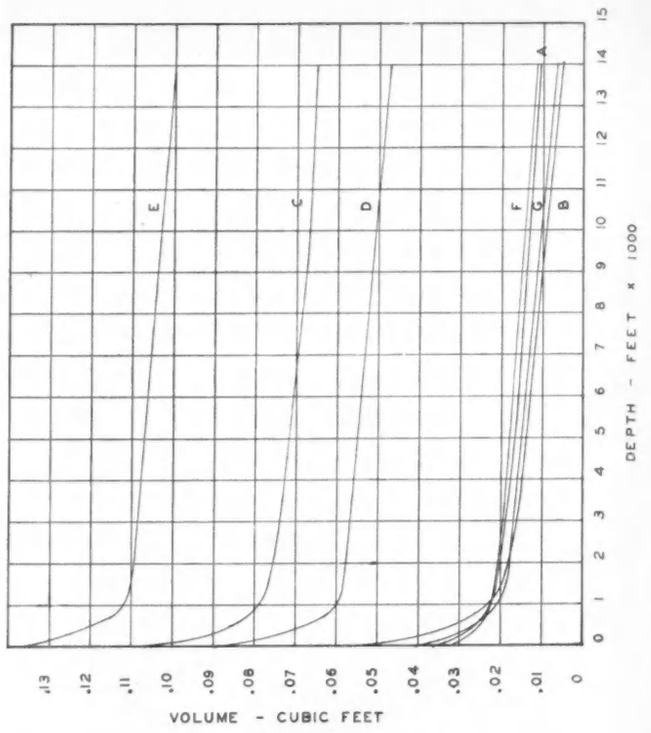

FIGURE 5. V_a for all bulk agents tested.

was taken for each compressibility factor.

Plots were made of compressibility factor vs. load. These were made on Cartesian coordinate, semi - logarithmic, and logarithmic graph paper. To facilitate ease in interpretation, it was decided to use Cartesian coordinate paper in the final preparation of the curves.

The original data were plotted as compressibility factor against load. As load is not readily applicable to field practice, values of load were converted to pressure units. This was accomplished by dividing the load in pounds by the area in square inches of the hydraulic cylinder piston. Compressibility factors were then expressed for given values of pressure. The units of pressure were in pounds per square inch.

Expressing compressibility factor as percent volume compressed, these factors indicate a decreasing value with a decrease in density of the bulk agents. There is, however, an exception to this generalization. Bulk agent 'B' does not show that trend. This variation was believed to be the result of two factors, specifically:

1. The high value of porosity of the bulk agent.

2. The inability of the bulk agent to absorb water.

Compressibility factors at various pressures are tabulated in Tables 4 and 5. The tabulations were arranged so that the values of compressibility factors appear under the respective letter headings. The respective pressures are read in the left hand column.

The figures follow the tabulation in order. Figure 2 is a plot of percent volume compressed vs. pressure. Figure 3 is a plot of percent volume remaining after compression vs. pressure. From the previous discussion these figures show compressibility factor curves.

There were no compressibility factors for values of pressure from 0-283 pounds per square inch. The rapid compression occurring in this range made micrometer readings impractical. The range, however, is of little consequence in this study. A pressure of 283 pounds per square inch is approximately equivalent to a depth of 400 feet. Loss of circulation occurring in this area is of little importance and may be easily corrected. Should compressibility factors in this range be desired, it is possible to extrapolate them from the curves.

In an attempt to aid any future study beyond the scope of this work, a correlation was made for volumes of bulk agents present at various depths.

The volume of bulk agent present at any depth is a function of the pressure exerted by the drilling fluid overburden. The pressures exerted by various drilling fluids at successive depths were calculated. These data were tabulated in Table 6 and plotted in Figure 4. In all

TABLE 6
Pressures Exerted by Drilling Fluids.

Depth, Feet	FLUID WEIGHT—Pounds per Gallon			
	8.33	9.35	12.35	18.00
000	0	0	0	0
1000	433	486	643	935
2000	866	972	1286	1870
3000	1299	1458	1929	2805
4000	1732	1944	2572	3740
5000	2165	2430	3215	4675
6000	2598	2916	3858	5610
7000	3031	3402	4501	6545
8000	3464	3888	5144	7480
9000	3897	4374	5787	8415
10000	4330	4860	6430	9350
11000	4763	5346	7073	10265
12000	5196	5832	7716	11220
13000	5629	6318	8359	12155
14000	6062	6804	9002	13090

TABLE 7
Volume of Bulk Agent Present for 1 Pound of Bulk Agent Per Barrel of Drilling Fluid.

Pressure, Psi.	BULK AGENT						
	A	B	C	D	E	F	G
000	0.0361	0.0562	0.1092	0.0998	0.1365	0.0321	0.0402
283	0.0239	0.0262	0.0800	0.0900	0.1133	0.0230	0.0224
500	0.0222	0.0210	0.0774	0.0595	0.1112	0.0218	0.0198
1000	0.0198	0.0174	0.0750	0.0574	0.1092	0.0202	0.0176
1500	0.0181	0.0155	0.0734	0.0562	0.1082	0.0191	0.0166
2000	0.0171	0.0143	0.0722	0.0551	0.1071	0.0180	0.0152
2500	0.0159	0.0126	0.0709	0.0542	0.1062	0.0170	0.0141
3000	0.0152	0.0120	0.0695	0.0532	0.1053	0.0162	0.0131
3500	0.0144	0.0108	0.0686	0.0521	0.1042	0.0152	0.0120
4000	0.0138	0.0097	0.0673	0.0511	0.1033	0.0144	0.0110
4500	0.0130	0.0085	0.0668	0.0502	0.1024	0.0136	0.0099
5000	0.0123	0.0074	0.0660	0.0492	0.1016	0.0129	0.0088
5500	0.0115	0.0062	0.0654	0.0482	0.1007	0.0121	0.0078
6000	0.0108	0.0054	0.0652	0.0472	0.0996	0.0114	0.0068

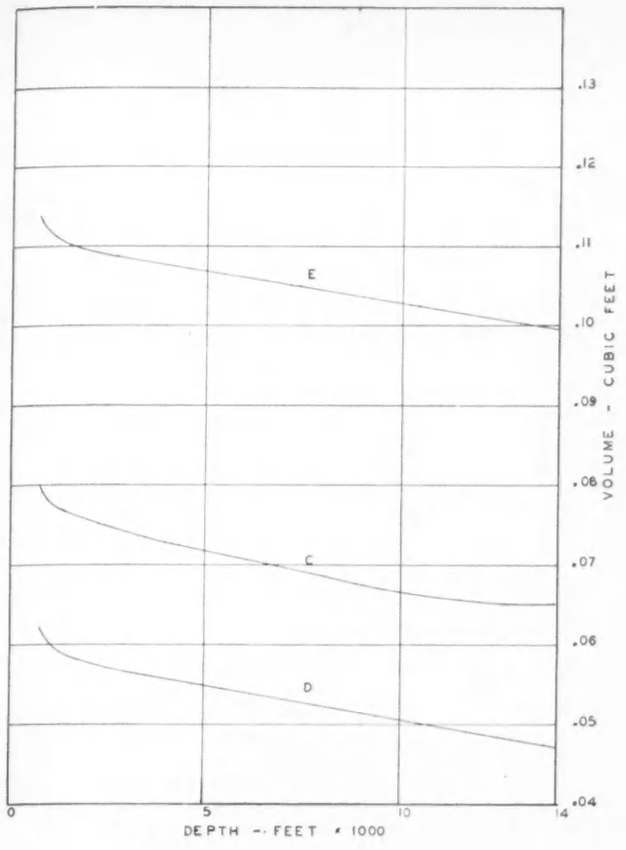

FIGURE 6. V_s for bulk agents C, D, and E.

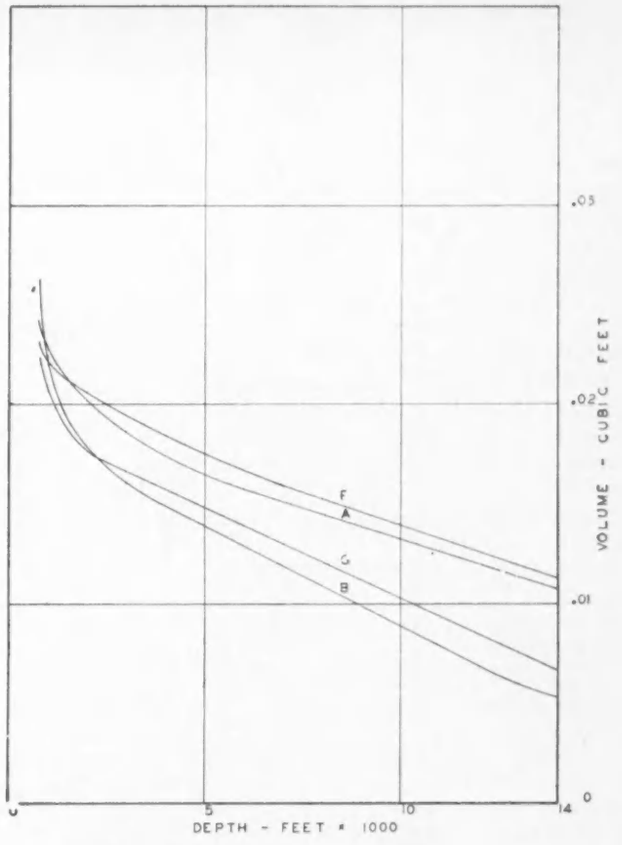

FIGURE 7. V_s for bulk agents A, B, F, and G.

cases a straight line relation on Cartesian coordinates was shown.

Assuming a unit of one pound of bulk agent per barrel of drilling fluid measured in cubic feet, calculations were made of the volumes present at different pressures. A further assumption was made that the drilling fluid was water. The following formula was used in these calculations:

$$V_s = F_b \times V_a$$

in which

V_s = volume in cubic feet of 1 pound of bulk agent per barrel of drilling fluid.

F_b = compressibility factor at a given pressure for a given bulk agent in percent volume of bulk agent compressed.

V_a = volume in cubic feet at surface conditions of 1 pound of bulk agent per barrel of drilling fluid.

The pressure values in pounds per square inch were converted to values of depth in feet. From these data, a plot was made of volume of bulk agent vs. depth. These data were tabulated in Table 7. Figures 5, 6, and 7 are a plot of these data.

TABLE 8

Mud Weight Conversion Factor.

Conversion Factor C_f	Mud Weight Pounds per Gallon
1.000	8.33
0.920	9.00
0.824	10.00
0.750	11.00
0.690	12.00
0.638	13.00
0.593	14.00
0.554	15.00
0.522	16.00
0.491	17.00
0.462	18.00

To facilitate use of the previously mentioned figures, a plot of mud weight vs. a conversion factor was made in Figure 8. Table 8 is a tabulation of the data used in this plot. This factor is for converting the volume of a bulk agent in water to its respective volume in a given weight mud.

Through the use of the previously mentioned figures, a calculation can be made of the volume of bulk agent present at various depths, regardless of the weight of drilling fluid.

The following formula makes the data applicable to field use:

$$V_b = V_s \times N_b \times C_f \times B$$

in which

V_b = volume in cubic feet of bulk agent present in the hole after compression.

V_s = volume in cubic feet of 1 pound of bulk agent per barrel of drilling fluid.

N_b = number of pounds of bulk agent per barrel of drilling fluid.

C_f = conversion factor for mud weight.

B = number of barrels of drilling fluid.

If the curves of Figures 5, 6, and 7 were not available, an approximate calculation of V_s could be made from the equations tabulated in Table 9.

EXAMPLE 1: A well is being drilled in a proven field. Circulation has been lost at 5300 feet while using a 10.5 pound drilling fluid. Previous drilling has indicated a porous, highly permeable sandstone at this approximate depth.

What is the approximate volume of bulk agent C going into the formation if seven pounds of bulk agent per barrel of drilling fluid is being placed in the

TABLE 9

EMPIRICAL EQUATIONS FOR DETERMINING V_s

Agent	Formula for Volume$_s$
A.	$V_s = 0.01958 - (0.633 \times 10^{-4} \times D)$
B.	$= 0.0189 - (0.100 \times 10^{-4} \times D)$
C.	$= 0.0769 - (1.041 \times 10^{-4} \times D)$
D.	$= 0.0589 - (0.833 \times 10^{-4} \times D)$
E.	$= 0.1111 - (0.833 \times 10^{-4} \times D)$
F.	$= 0.0152 - (0.667 \times 10^{-4} \times D)$
G.	$= 0.0195 - (0.793 \times 10^{-4} \times D)$

in which V_s = volume in cubic feet of 1 pound of bulk agent per barrel of drilling fluid.

D = drilling depth in feet.

mud pits? Capacity of the mud pits is 200 barrels.

The depth is 5300 feet.

Reading from Figure 6, bulk agent C at D = 5300 feet, has a volume of $V_s = 0.0715$ cubic feet.

$N_b = 7$.

Reading C_f from Figure 8 for mud weight = 10.5 pounds per gallon, $C_f = 0.785$.

Using the equation:

$$V_b = 0.0715 \times 7 \times 0.785 \times 200$$

The volume of bulk agent C going into the formation is 78.6 cubic feet.

EXAMPLE 2: The conditions are as given in Example 1. Bulk agent E is being used as a fibrous additive. The graphs are not available; therefore, the empirical equation is used to find V_s.

Reading empirical equation for bulk agent E from Table 9.

$$V_b = 0.11108 - (0.833 \times D \times 10^{-6})\ N_b \times C_f \times B$$

$$V_b = 0.11108 - (0.833 \times 5300 \times 10^{-6}) \times 7 \times 0.785 \times 200$$

The volume of bulk agent E going into the formation is 112 cubic feet.

Conclusion

This paper has set forth one criterion on which the use of bulk agents may be based. However, one criterion is not of sufficient magnitude to either condemn or advocate the use of specific types of bulk agents. Before these suggestions may be formulated, the effect of compressibility on the following factors must be fully considered and weighed:

1. The plugging ability of the bulk agent.
2. Changes in physical characteristics because of pressure.

The volume changes are evident in Figures 2, 3, 5, 6, and 7. From these data the bulk agents fall into two groups of curves. Bulk agents C, D, and E comprise the first group, and bulk agents A, B, F, and G comprise the second group. The materials appear to group according to physical characteristics. The first group is visibly more fibrous in general than the second group.

Should later research prove that the compressibility of a bulk agent is the governing factor in determining its fitness as an agent for the combatting of loss of circulation, this research has indicated a method for the determination of said compressibility. It has also given a guide as to the general types of bulk agents now in use.

Future research may be directed toward several objectives. The more important of these are the following:

1. Determination of the stability of filter cakes that are built by mixtures of bulk agents and drilling fluids.
2. Determination of the relative plugging ability of bulk agents after being exposed to pressure.
3. Determination of the pumpable limits of mixtures of bulk agents and drilling fluids.
4. Research leading to the condemnation of unsatisfactory bulk agents.
5. An instrument which will indicate the amount of bulk agent held in suspension in the drilling fluid.
6. Determination of the effect of mud weight on the plugging ability of bulk agents.

ACKNOWLEDGMENTS

The writer is greatly indebted to the following donors of materials: to Dowell Incorporated and Halliburton Oil Well Cementing Company who supplied the majority of fibrous materials used in this study, and to Pacific Pump Company, who supplied the parts for the hydraulic pressure cylinder.

Sincere appreciation is extended to A. E. Campbell of Stanolind Oil and Gas Company and J. V. Wintle of Wilson Rig Company for information concerning the use of fibrous materials in combatting loss of circulation in actual field practice.

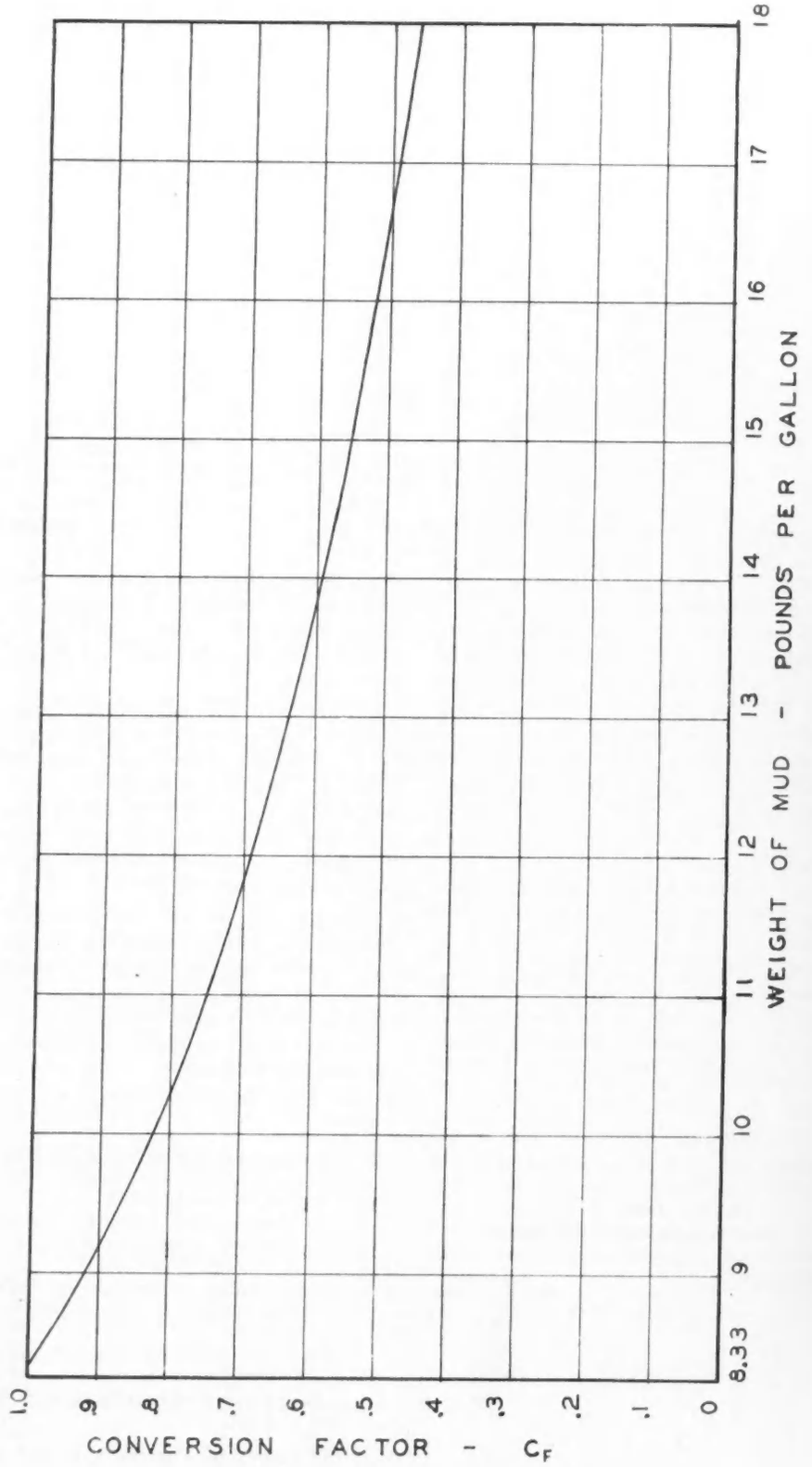

FIGURE 8. Mud weight conversion factor, C_f.

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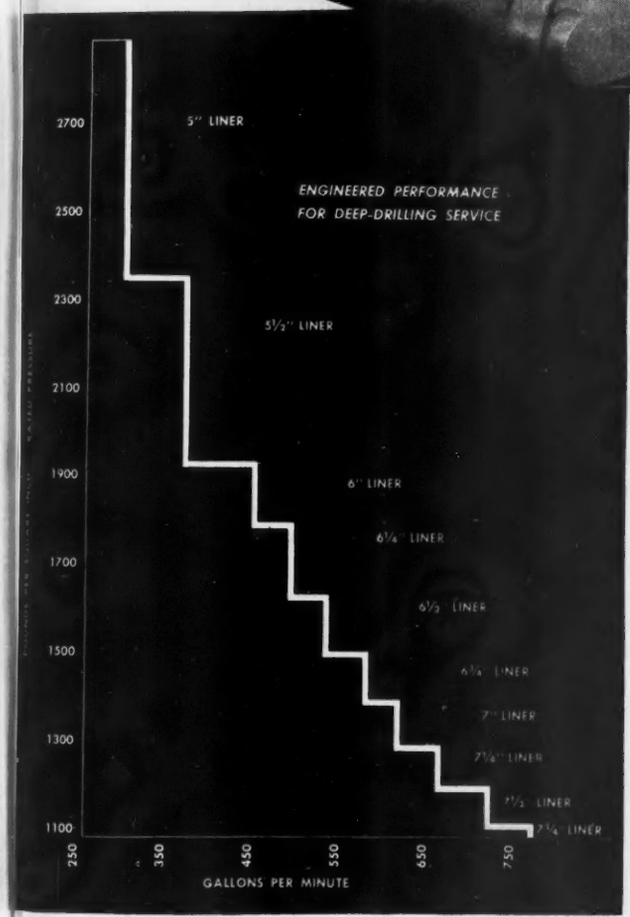

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Transporting Rotary Bit Cuttings

By G. C. MacDONALD,
Staff Engineer, Gulf Oil Corporation

RELATIONSHIPS BETWEEN pump characteristics and annulus are studied with reference to their effect on the transportation of cuttings up the hole, and recommendations are drawn up from convenient charts to show various combinations which must be met if effective cuttings removal is to result.

THE PROCESSES by which bit cuttings are transported to the surface in a rotary drilled hole are known to all; the mud travels upward through the annulus between drill pipe and hole carrying the cuttings which slip, or fall, slightly through the rising mud. The net upward velocity of the rising cuttings is the difference between the upward annular fluid velocity and the rate of cuttings slip through that fluid.

These fundamentals do not change, but the conditions under which they operate are quite dissimilar in soft formation and hard rock drilling. Some conditions favorable to the transportation of cuttings are naturally present in one type of drilling and absent in the other, due to the other drilling requirements which must be satisfied. For example, many sections of barren limestone and anhydrite could be drilled with clear water more rapidly and without fear of hole caving or damage to potential production if the water by itself would carry out the bit cuttings. Water alone is not always adequate to that task at all depths at usual annular velocities, hence commercial muds are often added in order to develop cutting carrying power. This is seldom, if ever, a problem in soft formation drilling because the requirements of wall building in that type of drilling automatically assure the use of a mud with good carrying abilities. On the other hand, the generally larger holes drilled through soft formations reduce the upward annular velocity of the mud for a given drill pipe size and pump throughput. An understanding of the fundamentals involved is therefore essential to assure the utilization of existing favorable conditions and the correction or alteration of those contrary.

All cuttings will slip downward through the rising mud at some definite rate and the mud must travel upward faster than the cuttings fall if the cuttings are ever to reach the surface. The rate of cutting slip downward is influenced by the cuttings' size, shape, and density; the mud density, type of flow, and viscosity while in that flow. The round large cuttings slip most, and small or flat cuttings are more readily carried out by the mud. The arrival at the surface of only small or flat cuttings is often an indication of an inadequate transportation system which may be allowing the larger cuttings to remain in the hole. These larger fragments may collect in cavities or "boil" above the drill collars until by further crushing action between drill pipe and wall, they are reduced in size sufficiently to permit their transportation in the existing mud system. This creates a drilling hazard and complicates the examination of samples which have arrived at the surface in the reverse order of their relative size rather than in the order in which the parent formation was penetrated by the bit. For all practical purposes the cutting size, shape and density cannot be controlled and hence alterations or improvements in the transportation system must be found elsewhere.

The upward velocity of the mud through the annulus between drill pipe and hole is a function of the rate of fluid circulation and the relative size of the drill pipe and hole. The circulation rate is, of course, a function of the pump liner diameter, the length of stroke, and the speed of the pump. For all practical purposes, once drilling below a casing shoe is begun with a given bit size and drill pipe and pump, about all the velocity control possible during drilling lies in the diameter of the liners in the pump and the speed at which the pump is run. This field is further narrowed by the mechanical limitations of the pump which usually require a progressive reduction in liner size as the hole gets deeper and circulating pressures increase. In effect, a maximum rate of circulation, and hence annular fluid velocity, is imposed by the pump which can be circumvented only by changing pumps or drill pipe size. It would be futile to change bit size only, because the situation in the existing hole would not be alleviated.

Pump Speed

There remains only the consideration of pump speed as being controllable during the process of drilling to alter the annular upward velocity of the drilling fluid. When steam or electricity is the motive power for the pump, that speed variation presents no great problem but on power rigs, pump speed changes are usually possible only with a corresponding change in the engine speeds. Variations in operating speeds

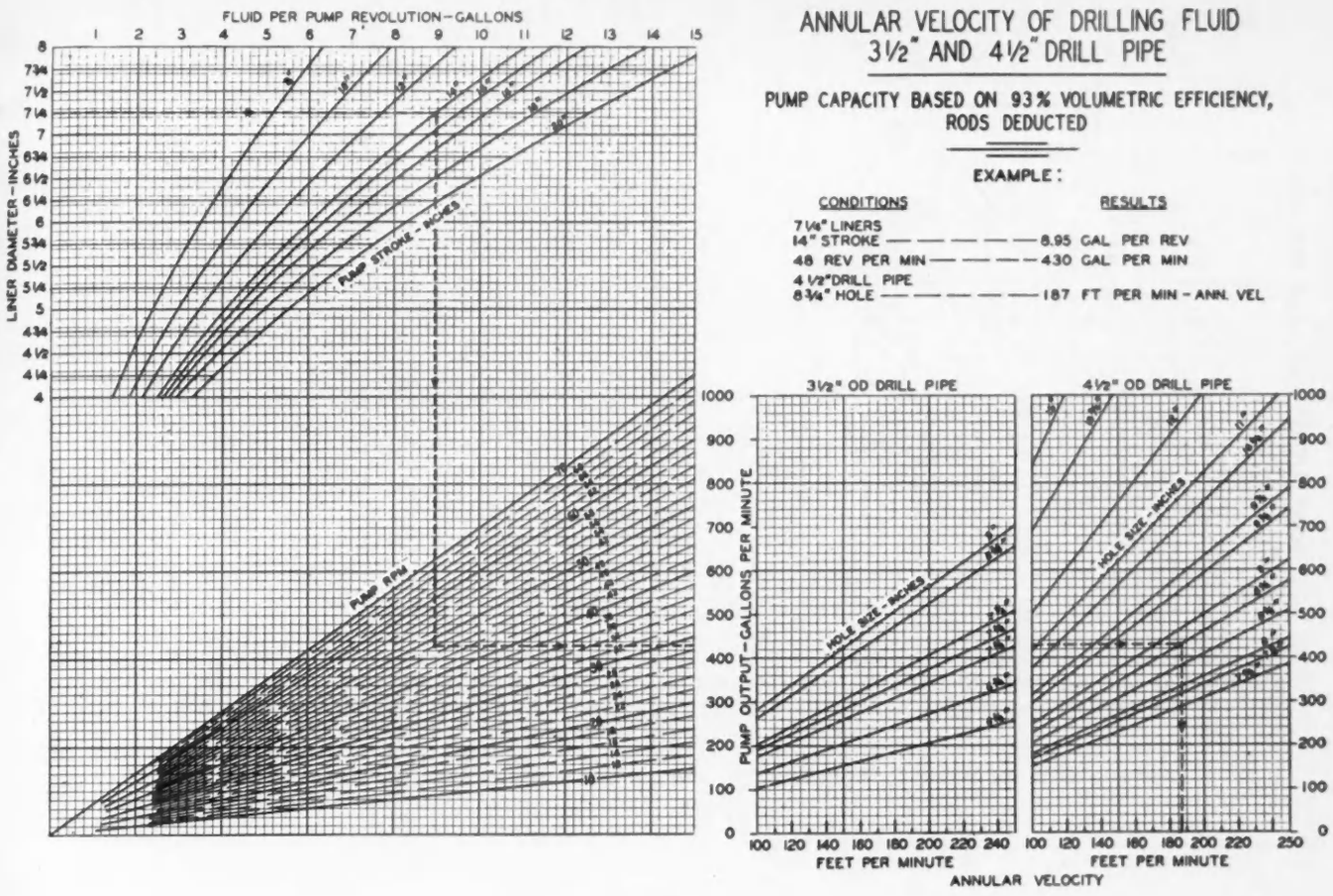
ANNULAR VELOCITY OF DRILLING FLUID
3½" AND 4½" DRILL PIPE
PUMP CAPACITY BASED ON 93% VOLUMETRIC EFFICIENCY, RODS DEDUCTED
EXAMPLE:
CONDITIONS
RESULTS
7¼" LINERS
14" STROKE — — — — — — 8.95 GAL PER REV
48 REV PER MIN — — — — — 430 GAL PER MIN
4½" DRILL PIPE
8¾" HOLE — — — — — — 187 FT PER MIN - ANN. VEL
FLUID PER PUMP REVOLUTION—GALLONS
LINER DIAMETER—INCHES
PUMP STROKE—INCHES
PUMP RPM
3½" OD DRILL PIPE
4½" OD DRILL PIPE
HOLE SIZE—INCHES
PUMP OUTPUT—GALLONS PER MINUTE
FEET PER MINUTE
ANNULAR VELOCITY

FIGURE 1.

of conventional internal combustion drilling engines are not too favorably regarded. Gear boxes on the pump drive are available on some rigs which do permit changes in pump operating speeds with a constant prime mover speed.

Alterations in the character of the drilling fluid are most easily accomplished and are limited only by economics and sub-surface conditions. It would be uneconomic to use an undersized pump and an expensive mud and it would be impossible to use a high weight mud if lost circulation were thereby induced. Consideration has been given to the employment of an annular fluid velocity which would develop the type of flow that would impart the greatest carrying capacity to a given mud. The mud properties and the rate of circulation would be correlated; the most effective rate might not necessarily be the maximum possible with existing pumping equipment.

Significance Varies

The significance of these factors varies with the type of drilling. Generally speaking, in soft formation drilling the carrying capacity of the mud will be high and hence a lower mud annular velocity is satisfactory.

The larger holes normally drilled through soft formations require more fluid to develop a satisfactory annular velocity even with the improved mud and the net result is the employment of larger pumps on soft formation drilling rigs. It would be inadvisable to establish some one empirical value for a universally satisfactory annular velocity. Too many factors enter into the final result, not the least of which are the mud character and the degree of hole enlargement. The theoretical annular velocity will be realized only through the true gauge section of the hole and excessive hole enlargement will reduce the actual velocity proportionately. Mid-Continent wells have been drilled satisfactorily through the Pennsylvanian section with an annular velocity of 160 feet per minute with ordinary mud. Caves exceeding 30 inches existed in the holes. In some of the hard rock areas of the Permian Basin slightly lower annular velocities have sufficed. In general, annular fluid velocities below 150 feet per minute in Mid-Continent drilling are unfavorably regarded and there is reason to believe that this minimum is too low for Gulf Coast drilling.

The mathematics required to determine the theoretical annular velocity is neither difficult nor involved, but the time required often acts as a deterrent to frequent calculation. If some ready means were at hand for determining annular velocities quickly and without calculation, it is beleived that they would be determined more often. That information, in the hands of experienced well drillers, should serve as an aid to the identification of down-the-hole trouble and should contribute to the accumulation of a fund of knowledge encompassing experience under many conditions, in all areas. The establishment of a range of basic values from minimum through satisfactory and to excessive annular velocities in all areas would prevent an attempt to drill under impossible mechanical conditions at one extreme and reduce the instances of uneconomic over-equipment at the other extreme.

Determine Velocity

A chart (Figure 1) is presented to facilitate the determination of annular velocity of mud in various size holes drilled with 3½- and 4½-inch drill pipe. It may be seen that pump liner diameters by ¼-inch from 4- to 8-inch are set out, pump stroke lengths from 8- to 20-inch, pump speeds from 10 to 70 revolutions per minute, and hole sizes from 6⅛- to 9-inch with 3½-inch out-

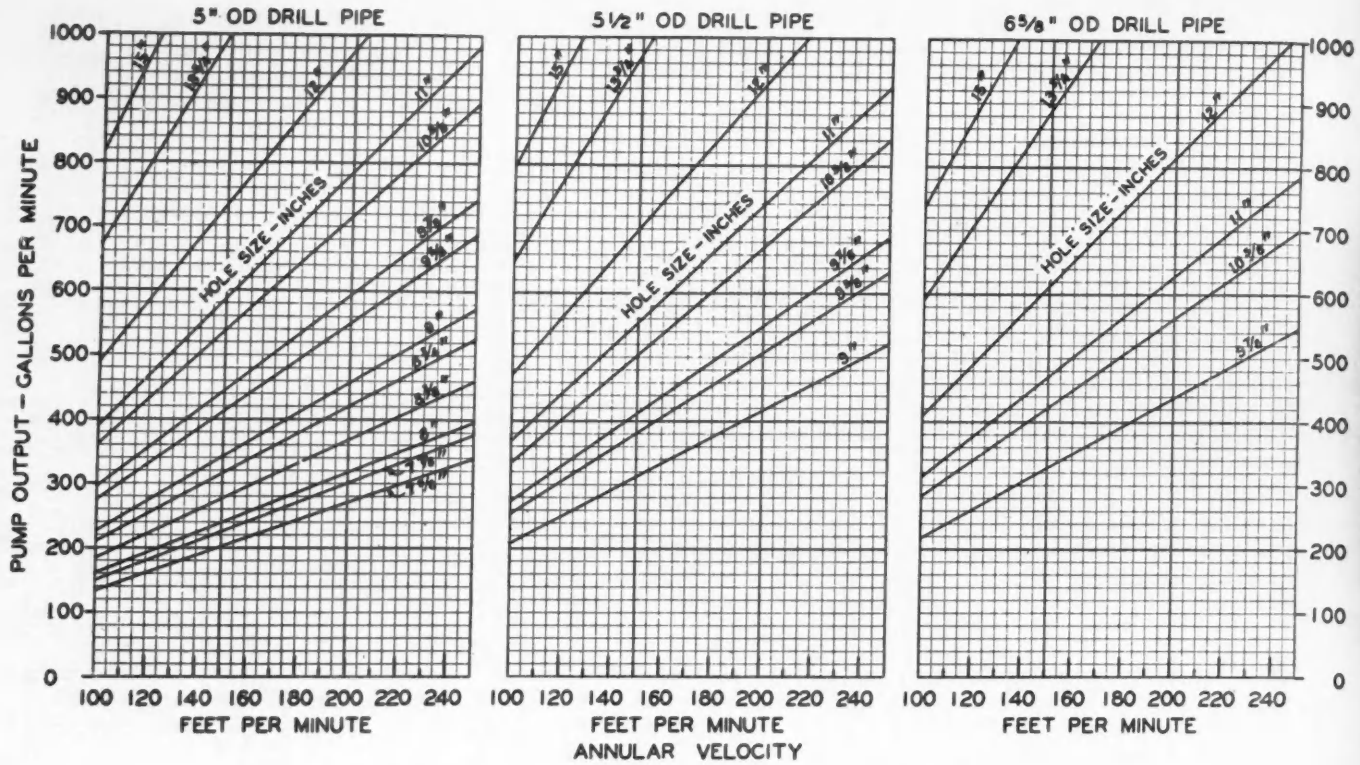

FIGURE 2. Annular velocity of drilling fluid in 5, 5½, and 6⅝-inch drill pipe.

side diameter drill pipe and from 7⅝- to 15-inch with 4½-inch outside diameter drill pipe.

An example is cited and illustrated wherein a pump with 7¼-inch liner and 14-inch stroke is turning 48 rpm and drilling an 8¾-inch hole with 4½-inch drill pipe. It may be seen that by entering the curve at the upper left side on the 7¼-inch liner diameter and proceeding to the right of the 14-inch stroke and then moving vertically downward to an intersection with a pump speed of 48 rpm and traveling thence to the right, a fluid output of 430 gallons per minute is indicated. To convert that to annular velocity between 4½-inch drill pipe and 8¾-inch hole, the first curve is skipped over because that is for 3½-inch drill pipe and the second, or right hand curve, is entered on the same 430 gallon per minute scale to an intersection with the 8¾-inch hole. By moving vertically downward to the annular velocity scale, a velocity of 187 feet per minute under the conditions set forth is read. Although not set out in the example, gallons of fluid per pump revolution is also available from Figure 1 by reading the upper scale directly above the intersection of the liner size curve and the length of stroke curve; in the case of 7¼-inch liners and a 14-inch stroke, the result would be 8.95 gallons per revolution.

Figure 2 displays the same information for various size holes drilled with 5-inch, 5½-inch and 6⅝-inch drill pipe. This set of three curves picks up with pump output in gallons per minute on the ordinate and displays annular velocity in feet per minute on the abscissa. It was not considered necessary to reconstruct that portion of the curve which displays the pump output at various liner sizes, length of stroke, and revolutions per minute.

Liner Size Reduction

As an illustration of one way in which Figure 1 may be used, the consequences could be considered of a reduction in liner size from 7¼- to 6½-inch under the same hole and drill pipe conditions above set out. With the pump still turning 48 rpm, the annular velocity of the rising fluid is reduced from its original 187 feet per minute to 148 feet per minute. This may or may not prove serious, depending upon other hole conditions, but 148 feet per minute is definitely within the marginal range, whereas the original 187 feet per minute should have been very satisfactory. If the original fluid output of 430 gallons per minute is needed with the smaller liners, it may be seen from the chart that the pump speed would have to be increased from 48 rpm up to 60 rpm. Whether or not this could be done on a specific and particular drilling rig would depend upon a number of things outside the scope of this discussion.

Mud Pump Use

The most efficient use of the mud pump could be made by using the largest drill pipe possible in each hole size. This reduces the cross-sectional area of the annulus and increases the velocity of the fluid for a given pump throughput. The upper limits of drill pipe size for a given hole are, of course, determined by fishing tool diameters. As an example, at 600 gallons a minute with 6⅝-inch drill pipe in a 12-inch hole, an annular velocity of 147 feet per minute would be developed, whereas if that 12-inch hole were drilled with 4½-inch drill pipe with the same 600 gallons per minute fluid output, an annular velocity of 119 feet per minute would be developed. In addition to the more favorable annular velocity possible with the larger size drill pipe, there would be the added advantage of lower pump pressures with the larger conduit provided by the larger size drill pipe.

No inference is intended or implied that the theoretical annular velocities herein shown are actually obtained in all parts of the hole. Hole enlargement is a normal expectancy and quite obviously lower annular velocity will be developed through those cavities; the values are relative rather than absolute. The 7¼-inch liners in the 14-inch pump above cited turning 48 rpm and developing an annular velocity of 187 feet per minute might prove entirely adequate to drill a given hole. However, as the hole gets deeper and the length of drill pipe through which the fluid must be pumped increases, the pressure needed to circulate may exceed the limitations of the pump. There is no question as to when to reduce the liners in a steam pump because with a given boiler pressure the

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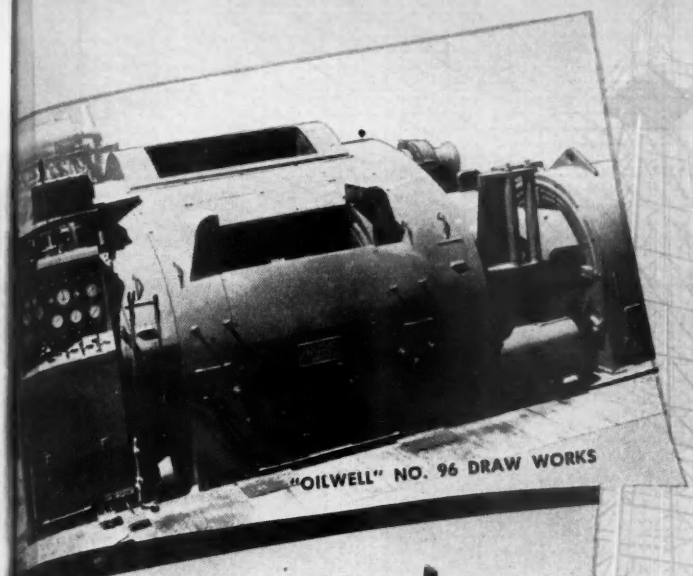

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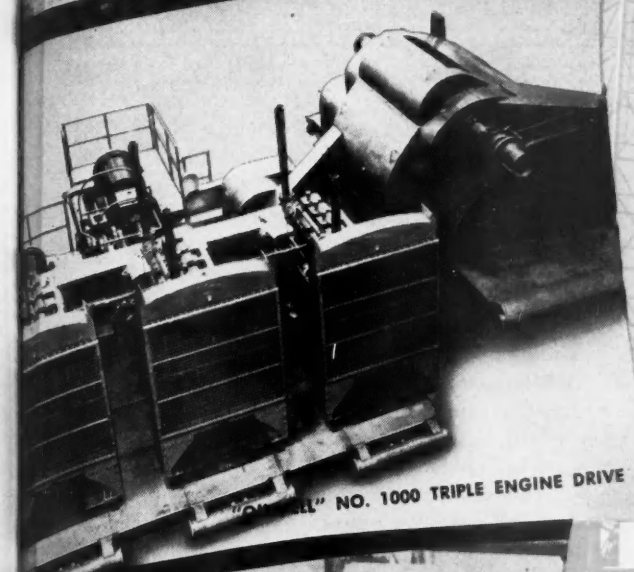

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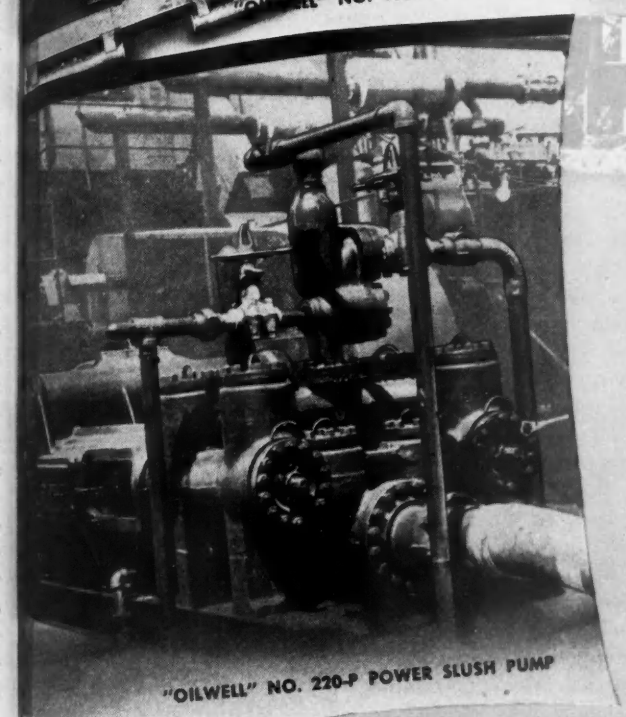

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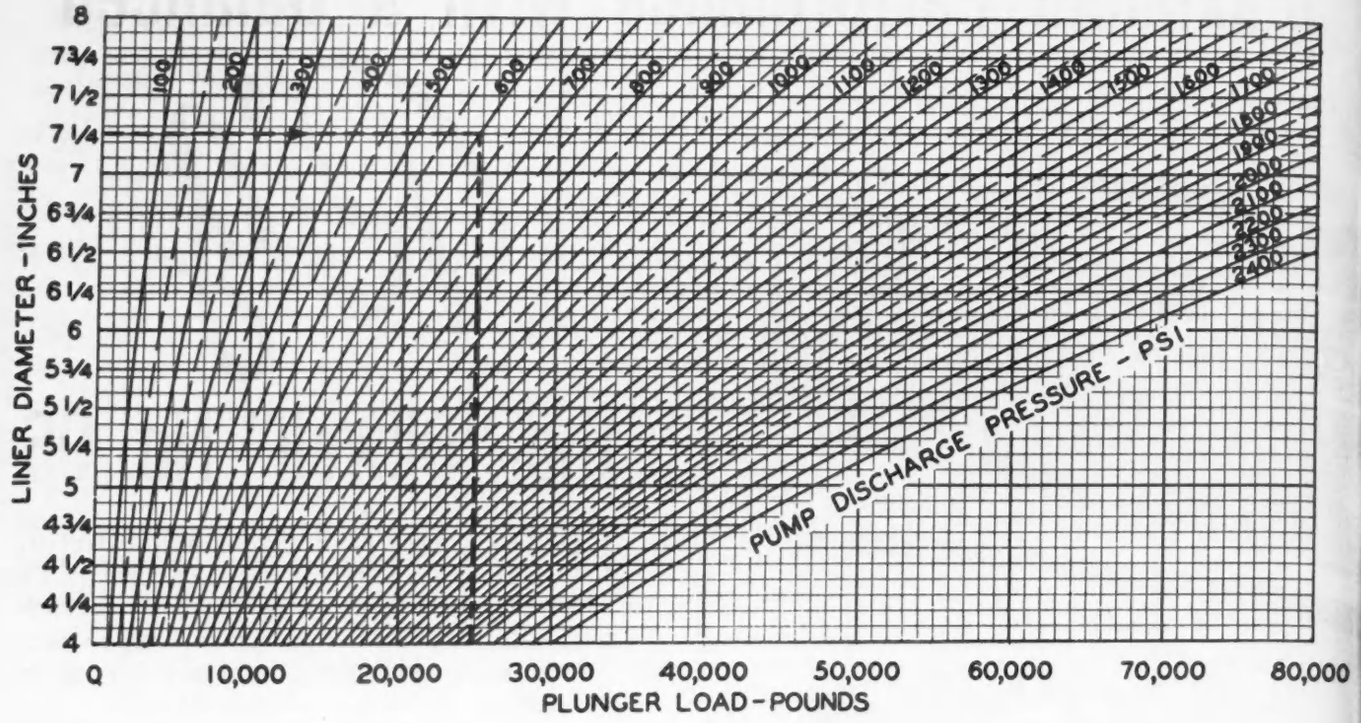


FIGURE 3. Pump plunger loads. *Example:* Conditions—7¼-inch liners, 600 psi. *Result*—24,770 pounds plunger load.

pump will refuse to operate beyond a fluid discharge pressure determined by the ratio of the diameter of the steam piston to the fluid piston.

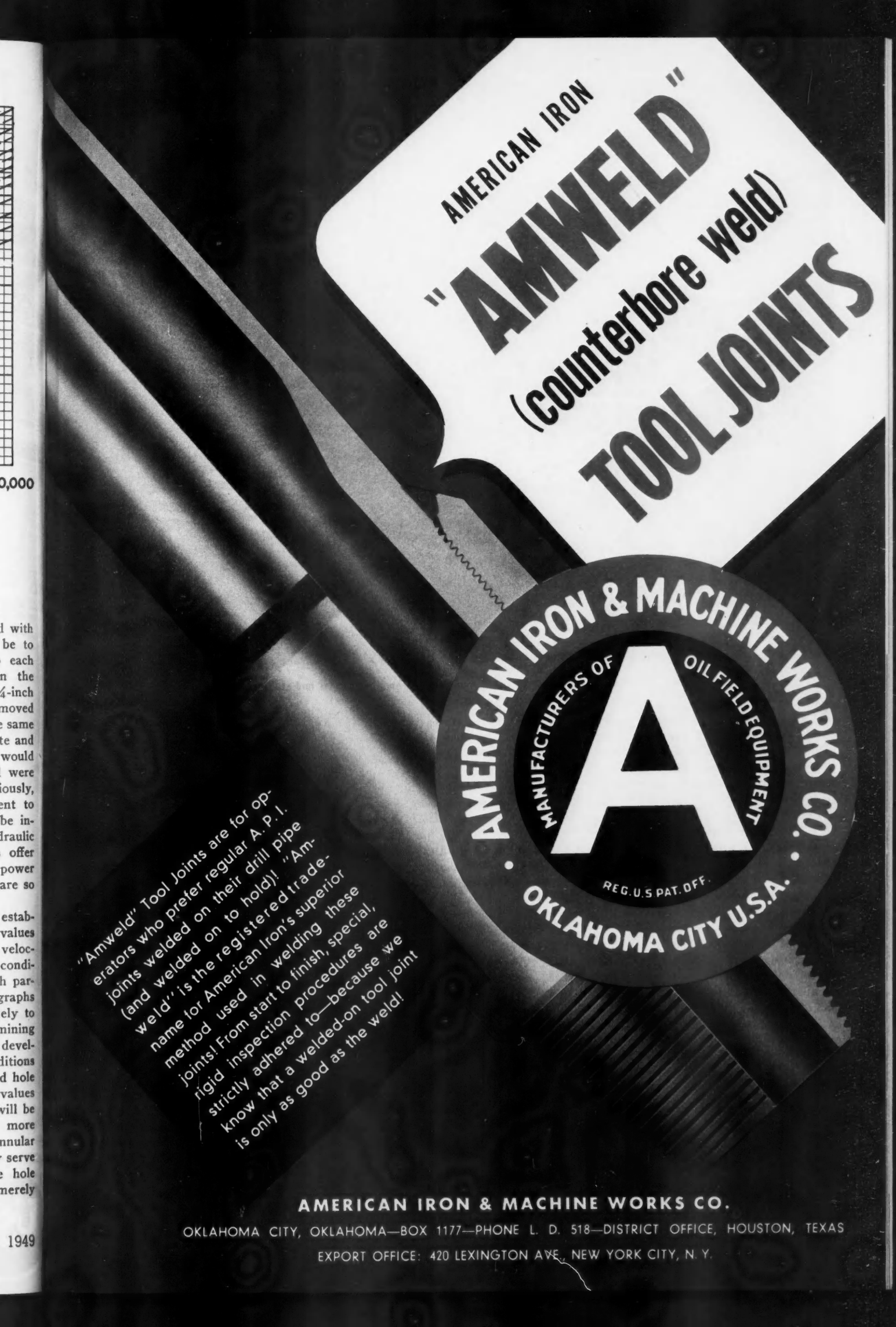
A power pump has no such automatic safety device. It is possible to operate a power pump beyond its mechanical ability and by so doing, damage it seriously in the gear end. It is the gear end of a power pump which limits the capacity of that pump; the fluid end is the same for all size liners and output pressure ratings. The load on the gear end is the product of the area of the piston times the pressure on it and when the pressure goes up the area must come down. Some pump manufacturers attach to the gear end of a power pump a name plate upon which is stenciled the maximum operating pressure for each sized liner; others will indicate the maximum plunger load to which the pump should be subjected without damage; others will include both of these values. Oftentimes when a pump is painted in the field, these name plates will be painted over and the actual values stenciled thereon obscured. Continued operation of a pump beyond its rated plunger load may not cause immediate failure in the gear end but it will definitely increase the wear on the parts.

Figure 3 is a graphical representation of the plunger load developed in the gear end of a power pump operating at various pressures from 100 to 2400 pounds per square inch with liners from 4- to 8-inch, inclusive. One popular oil field pump is designed for a maximum plunger load of 30,000 pounds. It may be seen from Figure 3 that with 7¼-inch liners a discharge of 725 psi would produce that maximum plunger load in that pump. When the liners are reduced to 6½ inches a discharge pressure of 725 psi would produce only 24,000 pounds plunger load and the pump discharge pressure may be increased to 900 psi before the 30,000-pound maximum plunger load is achieved. The discharge pressure is determined solely by the quantity of fluid, the type of fluid, and the length and size of conduit through which that fluid is pumped. Hence, there is no advantage in putting two pumps on in parallel and running them at half speed if the total quantity of fluid handled, and hence the discharge pressure, remains the same. There would be then two pumps overloaded instead of one if the one pump was overloaded originally.

Increase Pump Speed

Fluid demands for efficient drilling at extended depths are equal to, if not greater than, the fluid demands of the same sized hole at shallower depths, but the increased pressures at greater depths usually require a reduction in liner sizes and hence a reduction in fluid circulated at or near the bottom of the hole, the point at which the fluid is most needed. One obvious manner in which the annular velocity could be maintained with a reduction in liner size would be to increase the speed of the pump each time the liners are reduced. In the example previously cited where 7¼-inch liners in a 14-inch pump are removed and replaced by 6½-inch liners, the same fluid output of 430 gallons a minute and hence the same annular velocity would be maintained if the pump speed were increased from 48 to 60 rpm. Obviously, there are limitations to the extent to which power pump speeds may be increased. Electric motor drives, hydraulic couplings, and torque converters offer the greater range of flexibility in power pump operations but not all rigs are so equipped.

It is not the writer's intent to establish any arbitrary or empirical values for annular velocity; the annular velocities needed to drill under given conditions must be determined for each particular set of circumstances. The graphs herein presented are intended solely to provide a ready means of determining the annular veolcities that will be developed under the most common conditions of pump size, speed, drill pipe, and hole size. It is believed that if these values can be determined quickly, they will be determined more frequently. A more precise knowledge of just what annular velocities are being developed may serve to explain happenings down the hole which otherwise might prove merely puzzling.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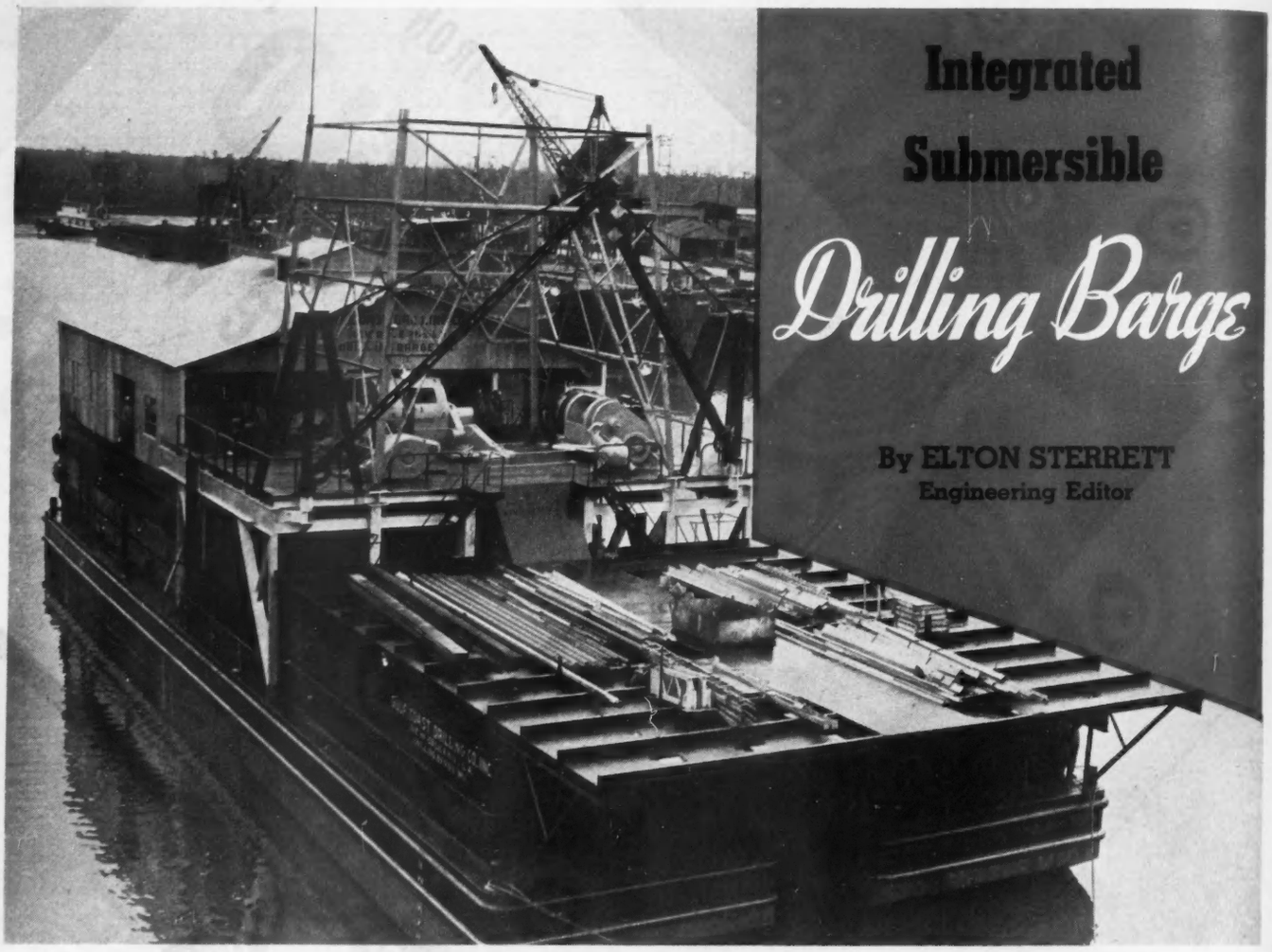


Integrated Submersible Drilling Barge

By ELTON STERRETT
Engineering Editor

Bow view of barge, showing pipe racks, twin material-handling cranes and stub of derrick.

SUCCESSFUL exploitation of the underwater oil fields on the Gulf continental shelf, including offshore and shallow inland waters, is opening up what promises to become one of the largest oil reserves in the U. S. This development, which usually calls for very large and heavy equipment, presents many operating problems not encountered in land drilling. It is only natural, therefore, that petroleum men should avail themselves of the experience and skill of marine engineers in working out these problems.

Use of submersible barges carrying permanently installed drilling equipment dates back to 1933, when The Texas Company drilled the first well by this method at Lake Barre in South Louisiana. The barge, "McBride," a twin-hull vessel, is still in service. A second barge, the "Gilliaco," was commissioned later.

Drilling from submersible barges offers important advantages over drilling with equipment supported on elaborate matting or on stationary platforms erected on piling. Upon completion of a well, a barge, with all equipment intact, may be moved to the next location in a matter of hours. To dismantle, move, and reassemble a platform and all the machinery takes at least two or three weeks, and frequently more, during which time the equipment necessarily remains idle.

Encouraged by the results obtained in the early operations, The Texas Company contracted for a third barge which was built in 1934 by the Pennsylvania Shipyard, now the Beaumont Yard of Bethlehem Steel Company, Shipbuilding Division. This barge, the Wilkins, was of the slotted, or U, type. As other oil companies and private drilling contractors adopted the method introduced by The Texas Company, the demand for barges increased, and the Beaumont Yard has turned out 42 new drilling barges, well over one-half the total number built. This figure does not include boiler barges or reconditioned and converted craft.

Heretofore the accepted practice has been to build the barge hulls in regular shipyards and deliver them to the owners for rigging up and installation of machinery and equipment. The barge, Gulf Coast No. 1, recently built at the Beaumont Yard for Gulf Coast Drilling Company represents a distinct departure from this procedure.

Realizing the advantages that might be gained by having a drilling barge designed, built, equipped and rigged up by one and the same concern, as a turn-key job, the owners of Gulf Coast Drilling Company, J. J. Rebstock and R. H. Reeves, decided to have the Beaumont Yard undertake the construction of the Gulf Coast No. 1 on such a basis. Having pioneered in submarine drilling, first as driller and field superintendent for The Texas Company during the inception of barge drilling, and later as an independent operator, Reeves had become fully convinced that this was the proper way to avoid improvisation.

In constructing the Gulf Coast No. 1 the first step was to select the type and size of drawworks and other main equipment, around which the barge was designed. A U-type barge, of all-welded construction, 140 x 52 x 11 feet, was found to be the most suitable for the requirements. In the layout the mud pumps have been placed on the main deck, enclosed within a 6-foot watertight seawall, with access through 30-inch gates. Above the pump level, in the forward end of a 48- x 60-foot deck house, are three diesel engines furnishing the motive power for drawworks and slush pumps. The drawworks is on the derrick

substructure, forward of and four feet above the diesel engines.

Interchangeability was a prime consideration in the selection and arrangement of all equipment, to insure maximum flexibility and minimum interruption.

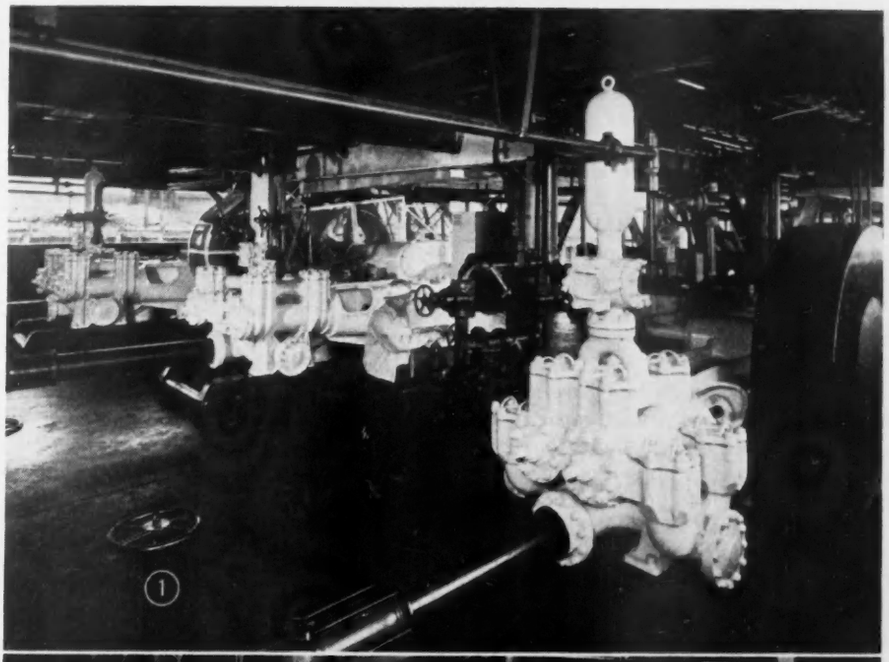
The hull is of longitudinal framed construction, with intermediate buck frames, and is divided into various compartments forming four ballast tanks and one fresh water tank, of 8- x 58- x 11½-foot, or 950-barrel, capacity, located aft.

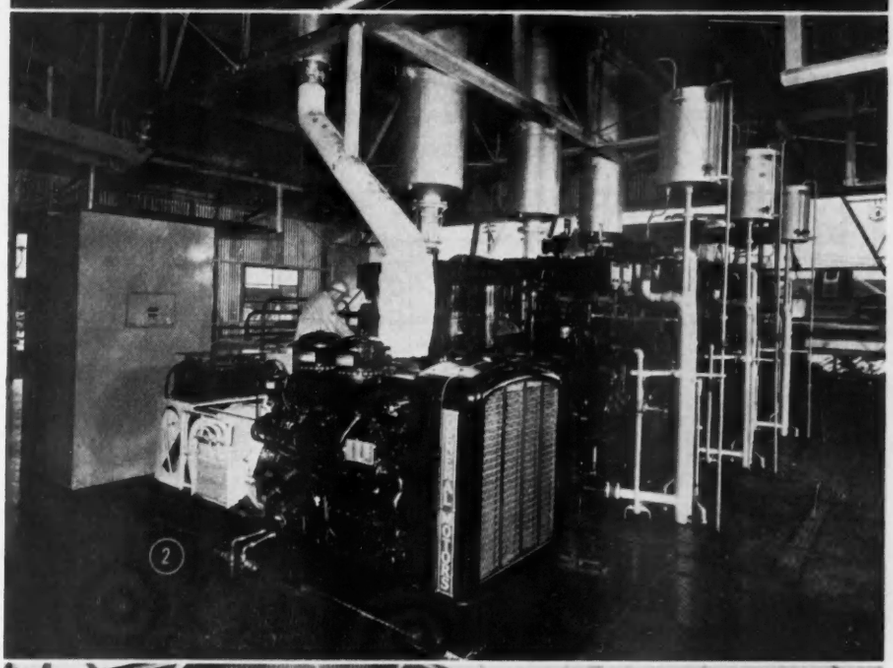
An important feature in the design of the derrick sub-structure is that the deck area below the derrick floor has been left entirely free from all obstructions. It is a 30- x 30-foot truss-type structure with an 8-foot overhang for the drawworks, and is supported on heavy builtup girders and columns carried down to the bottom, where the loads are dissipated in the structural members of the hull. This sub-structure is capable of supporting 250,000 pounds per derrick leg, plus the regular incidental loads, including the drill stem.

The drawworks has a rated capacity of 1,400 input horsepower and 15,000 feet drilling with 4½-inch O.D. drill pipe. It is powered with three diesel engines with dual fuel connections. The diesel engines, which can be used singly or in combinations of two or three, are cooled by heat exchangers, one for each engine, using sea water supplied by centrifugal pumps capable of delivering 175 gallons of cooling water per minute to each engine.

Two 7¾- x 18-inch slush pumps, with 600 input brake horsepower, are driven from any one or all of the diesel engines by multiple V-belting through a transmission drive on the upper level. In addition to the slush pumps the following equipment is driven through the engine compound: A 5 x 10 reciprocating, high-pressure fresh-water pump; a stand-by 25-KW generator, and a compressor delivering air at 100 pounds pressure.

The rotary table is a new model which was introduced a few months ago. It has a 21-inch opening, a rated capacity of





1. Mounting of slush pumps, with flexible couplings in suction lines to eliminate effect of vibration and to absorb temperature changes in line length. Pumps are V-belt driven from transmission shaft through individual clutches.

2. Mounting of the three diesel engines which power drawworks and mud pumps. In the foreground is the unit providing electric current for auxiliaries and lighting service. Units are mounted to beams of barge deck, insuring permanent alignment.

3. The drawworks and rotary, set so as to take drive from the main transmission unit, and provided with pneumatic controls from the driller's pulpit. The sand line reel is individually controlled, and is permanently located on the port side of the barge.

16,000 feet with 4½-inch O.D. drill pipe, and a recommended maximum speed of 300 revolutions per minute.

Included in the hoisting equipment are a six-sheave crown block and a five-sheave companion traveling block, of 350 tons capacity. The swivel is a unit of 300 tons rated capacity, at 100 rpm. A 1⅜-inch-diameter, 6 x 19 special rotary drilling line is used. The coring reel has a capacity of 15,000 feet of 9/16-inch-diameter pipe, and is individually driven by a diesel engine.

The derrick has a 30-foot base and is 136 feet high. It has a load capacity of 1,100,000 pounds and is built to withstand wind velocities up to 125 miles per hour. A 10- x 10-foot stacking board is designed for a load of 8500 pounds per square foot. The rathole, made up of 20-inch-diameter pipe, is fitted integrally with the hull, with an opening on the derrick floor.

Heavy wood flooring, consisting of two three-inch layers with building paper and asphalt waterproofing between, is used around the rotary table and checkered plate outboard of the drawworks. An interesting new feature is that all columns and girders in the derrick sub-structure have been metallized with a heavy coating of zinc, for corrosion protection. This precludes any warping or weakening of the heavy members, as may occur when hot-dip galvanizing is used.

The pipe-rack area is forward of the derrick floor and six feet below it, on both sides of the slot. By adding a ten-foot overhang this rack has been made amply long for accommodating range 3 casing. The area is supported on a series of columns and beams, and is plated entirely over on the underside of the beams.

Dragway

Over the slot is an eight-foot dragway of half-inch plate. This dragway has been made removable, to give full substructure clearance when the barge is moved off the well. Leading up to the derrick floor is a six-foot ramp over which the drill pipe is dragged into location above the rotary table, ready to be lowered into the well. The pipe rack is served by two five-ton derricks with 35-foot booms, one on each side of the derrick floor.

A 7- x 14-inch slush pump is used as a mud-mixing and mud-transfer pump. This pump has an input horsepower rating of 150 and is powered with a diesel engine.

In designing the barge, extra-large space was given to mud pit and mud storages. Two active mud pits, with connecting sluice gate, 11 x 22 x 5 feet and 11 x 26 x 5 feet, with room for 215 and 255 barrels, respectively, are built integrally with the barge, aft. Above the pits are two large, 11- x 18- x 9-foot mud houses, with sliding doors. A portable subway grating has been installed over the mud pits, between the two houses.

Water for the mud system is delivered from the fresh-water tank by a reciprocating high-pressure pump of 180 gallons per minute capacity.

Two reserve mud tanks, each 17½ x 22½ x 7 feet, or 491 barrels, are located forward, one on each side of the slot. Ahead of these, at the extreme forward end, are two 15,000-gallon fuel oil tanks, providing sufficient fuel capacity for two months' normal operation. A transfer pump of 50 gallons per minute capacity is used for pumping the oil from the main tanks to two 750-gallon day tanks on the derrick-floor level.

Electric power is supplied by a 60-KW, 115/230-v., diesel-driven DC generator located in the engine compartment. A compressor of 30-cubic-foot capacity, driven by a 10-hp motor, delivers air of 200 pounds per square inch pressure. Water for wash-down and general purposes is supplied by a 2½-inch centrifugal pump driven by a 10-hp motor.

The engine house is of steel framing with corrugated steel sidings. Two overhead hollow metal doors, 10 feet wide and 8 feet high, allow ample space for handling the heavy machinery in and out of the house. A monitor roof with projected steel sash provides natural ventilation.

The quarters have been laid out to insure maximum comfort and convenience for the crew. They include a tool pusher's room, with four bunks with inner-spring mattresses; office, galley, shower and toilet compartments, all separated from the machinery space by a bulkhead of 1-inch car siding; 5/8-inch plywood is used for covering the wooden partitions and the overhead, and the walls and ceilings enclosing the quarters are insulated with a 4-inch thickness of fibre glass. A 30-inch attic-type fan, installed

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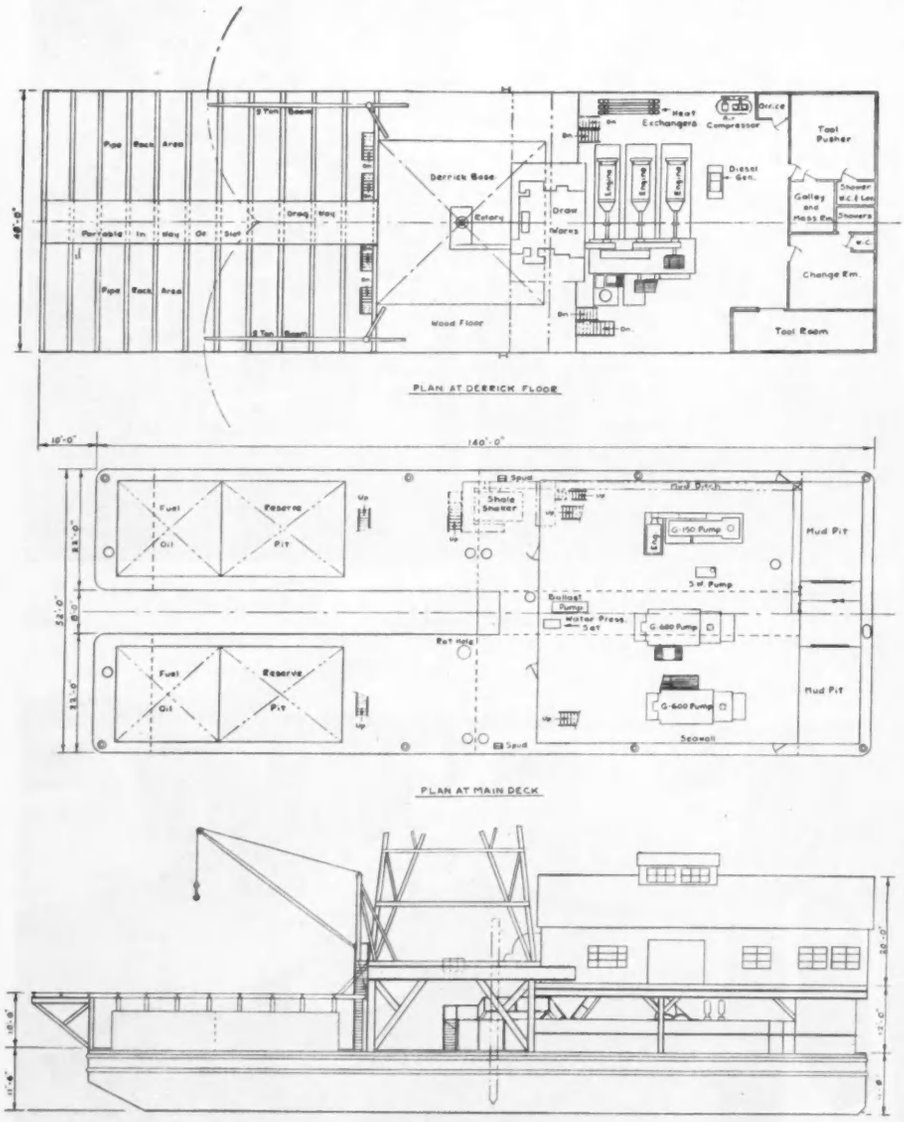

OUTBOARD PROFILE

Schematic arrangement of equipment on the barge, and outboard profile from the port side showing freeboard, submersible depth and overall dimensions of the unit.

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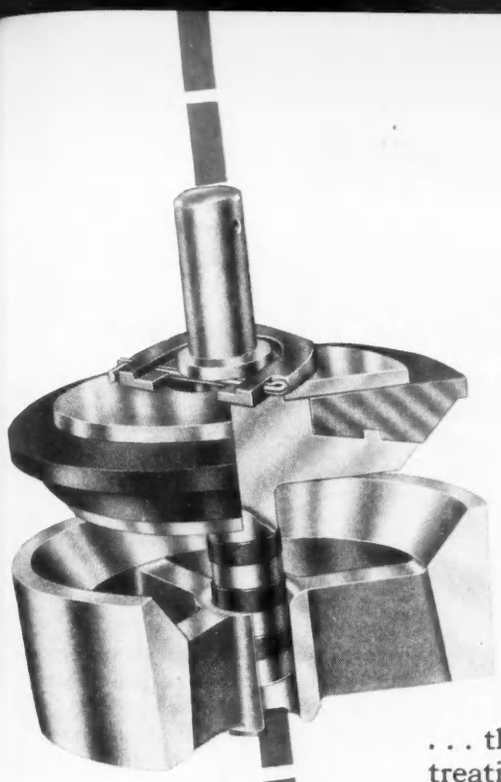

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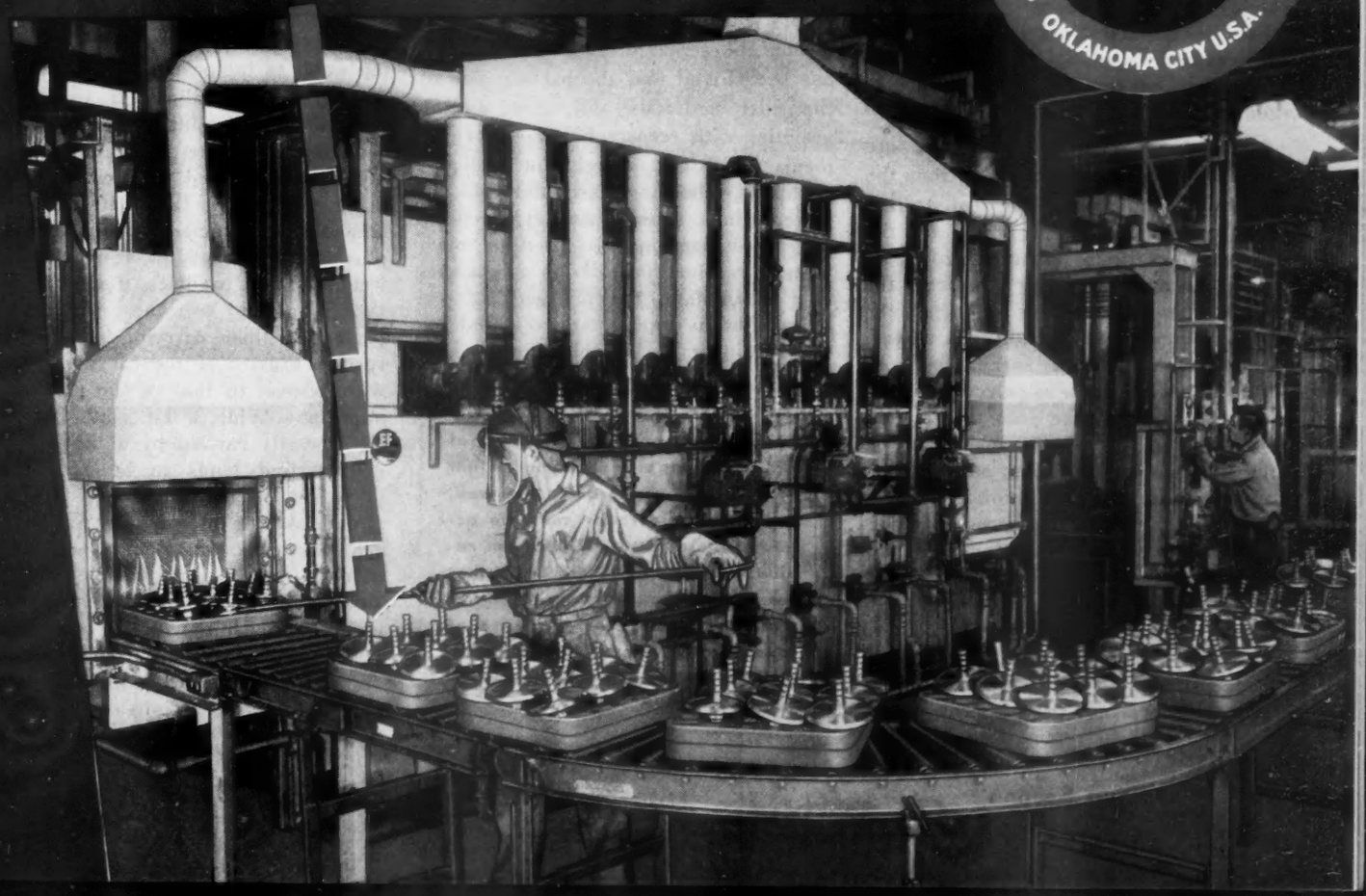

Applications of Surface Plugging Agents In Oil and Gas Wells

By A. A. TOWNSEND
Development Engineer,
Dowell Incorporated

SURFACE plugging agents of various types and materials have been used for many years in the drilling of oil and gas wells to overcome the problem of lost circulation of drilling mud. In this application, the surface plugging agents are added to the drilling mud with the thought that these agents will screen out against the face of a porous formation and build up a barrier to oppose further passage of mud into that formation. The necessity for this application lies in the varying permeabilities and pressures encountered in the underground formations through which the well is drilled. These permeability and pressure differences are often of considerable magnitude, and in some areas, may occur within very short intervals. The action of the filler materials, then, is purely mechanical, the materials acting to reduce the permeability of a highly permeable zone. This enables that zone to support a column of fluid of greater hydrostatic pressure than the producing pressure of that particular zone.

Surface plugging materials also are used in many applications other than the primary one of controlling lost drilling mud circulation. Among these are the testing of various potential producing zones during the drilling of a well, the application of plastics for sealing off the entry of undesirable fluids into a well, and the acidizing of specific sections within a well, known as selective acidizing. It readily can be seen that a temporary plugging material which can do the job in one application, such as that of controlling lost circulation during the drilling of a well, is not necessarily correct for another application, such as that of applying plastics to a well. The materials used in conjunction with drilling mud for recovering lost circulation are often fibrous and bulky, the object being to gain a maximum of surface area for its plating effect on the formation and still to retain a high tensile strength in the plugging material to help support the mud column. The specific gravity of the material usually is not of particular consequence as the viscosity of the drilling mud will hold it dispersed and in suspension in the mud, so long as the surface area of the particles is large in respect to their weight. And, too, the particle size of the material usually is not of consequence within reasonable limits; some of the best of these materials have no definite shape or size except for the one requisite that the materials have large surface area in respect to their weight.

Particle Sizes

In most of the applications for temporary plugging materials other than during the actual drilling of a well, it has been found that the particle size of the filler materials and their specific gravities with respect to their carrying media are rather critical. For such applications, laboratory tests and field experience have shown that solid particles of graded sizes may be used to much better advantage in order to gain a specific result than the materials of the bulky, fibrous type commonly used for the regaining of lost circulation. This can be projected to the extent that the particles should possess certain structural shape, such as angular or spherical. And, in most applications, it is desirable to introduce these materials into a well in a definite ratio of particle sizes and amounts of the material to the particular carrying medium, depending upon the formation conditions involved. In certain workover and remedial applications, such as that of deepening to a new pay zone, it may be desirable that the surface plugging materials be acid soluble to afford their positive removal from a low pressure, former pay zone. Generally speaking, then, the surface plugging materials used in applications, other than that for lost circulation of drilling mud, consist of two classes, the insoluble and the acid soluble, and are further differentiated by their particle sizes and specific gravities.

The carrying media for the surface plugging materials may consist of drilling mud, as in formation testing, or of plastic, as in sealing off undesirable fluids or of acid solutions, as in selective acidizing. In some applications special mixes are prepared with oil and other fluids. Due to the fact that the surface area of the particles used in these applications is small in respect to the weight of the particles, it may be seen that in order to keep these particles dispersed in their carrying medium, the specific gravity of the carying medium with respect to that of the particles is important. While a flat, plate-like particle is easily carried by a moving fluid column and tends to be carried dispersed and face-forward in the fluid stream, due to the forces acting upon it, the spherical or angular shaped particle tends to remain dispersed and to be carried by the stream only due to its close mass relationship with the stream. As good dispersion of the particles in their carrying medium can be as important to the success of the job as is the total quantity of the particles, the fluid car-

PARTICLE SIZE and specific gravity of filler materials play a very important part in their action down the well, and due consideration must be accorded these factors if optimum results are to be obtained. The author has here reworked material earlier presented at a joint meeting of Texas local sections of the Petroleum Division, AIMME, at Austin, December 16-17, 1948.

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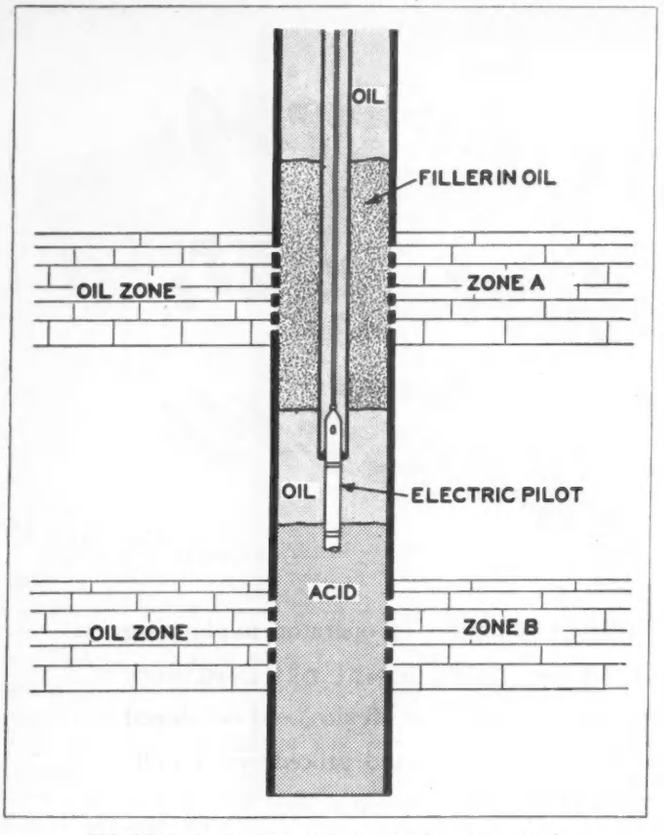

FIGURE 1. Acid soluble fillers assist in acid control.

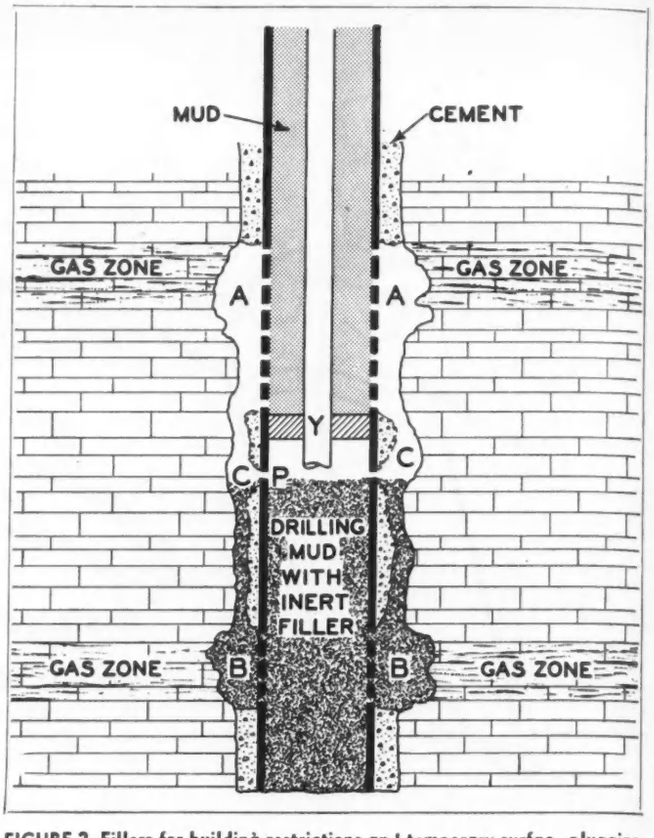

FIGURE 2. Fillers for building restrictions and temporary surface plugging prior to channel repair.

rying medium then becomes quite important and should be prepared especially for the particular job at hand. Experience in a particular area is relied upon quite heavily in preparation of the carrying medium and in selections of the proper particle sizes for a particular job as there is no real criterian upon which to base this judgment. Where formation testing of potential producing formations during the drilling of a well is concerned, careful study of the drilling log, core data, if available, and electric logs may be of great help in determining the proper particle sizes and the quantity of particles necessary for use in a particular application. A permeability profile of the well, used in conjunction with formation pressure data, gives the most accurate and complete information upon which to base the preparation of the materials.

Applied in Stages

Surface plugging materials in most of their appplications usually are applied in stages, the proper mix for the various stages being dependent upon the results obtained by the previous stage. The results of an application are noticed easily, either by a rise in the static fluid level within the well or by an increase in surface pressures, where materials are being pumped into the well. By staging the materials it is possible to decrease the permeability of a particular zone until the zone has built up almost any desired resistance to fluid flow. Also, it is possible to seal off completely the flow of fluid into the zone by reducing the permeability of that zone to nil. Where zero permeability is desired, the customary practice is to reduce the permeability to a low figure through the use of particles and then, by the application of several barrels of high viscosity drilling mud, to halt completely the flow of fluid into the zone. It is apparent that, in order for the particles to do their work, it is necessary that they be screened out of their carrying medium and deposited against the face of the formation. This means that some of the fluid necessarily must be lost into that formation. Therefore, it is essential that the carrying medium be such that it is not harmful to an oil- or gas-burning horizon where that particular horizon is to be temporarily plugged.

Temporary Plugging Materials

In the case of formation testing where a heavy mud column is necessary for control and where a low-pressure zone of potential production is exposed, the application of temporary plugging materials is very similar to that in the case of lost circulation of mud during drilling of the well. The proper mix of materials is determined and this mix is introduced into the well, usually by stages, until the necessary resistance to support the mud column has been gained in the low-pressure zone. Following completion of the test, the permeability of the low-pressure zone may be regained easily,

About the Author

A. A. TOWNSEND attended the Colorado School of Mines from which he was graduated with a B.S. degree in petroleum engineering in 1934. After graduation he joined Phillips Petroleum Company as a junior engineer and worked in Oklahoma and West Texas oil fields. In 1936 he joined Dowell Incorporated as service engineer in Seminole, Okla., and was advanced to sales engineer. In 1942 he joined the Army Air Corps, served four years, and was discharged with the rank of lieutenant colonel. He rejoined Dowell as district engineer in Shreveport and in 1947 was transferred to Tulsa, where he holds the position of development engineer.

where this is desirable, by reversing the pressure differential or washing. In such an application, the concentration and rate of injection of the plugging materials in their carrying fluid can be rather a problem in order to prevent plugging of the tubing or plugging of the port holes in a side-door choke, where used. Where pipe is in the hole, channeling between the surface plugged zone and the zone being tested is rather a common occurrence during the operation. However, this situation can be remedied without losing the plug across the surface plugged zone by taking prompt steps to build up restrictions in the channel. Here, the building up of restrictions in the channel through the use of additional plugging materials will result in rising pressures which, in turn, may cause additional channels. Accordingly, experience has shown that as long as the rising pressures show individual, sharp breaks, the plugging material should continue to be applied until these pressure breaks no longer occur. This situation is analogous to that which often occurs in cement or plastic squeeze jobs for zone abandonment or reduction of water-oil ratio.

In the application of plastics for the sealing off of undesirable fluids within a well, penetration of the plastic into the formation may be closely controlled through the use of surface plugging agents. Laboratory tests indicate that the extent of penetration of the plastic into the formation, where these filler materials are used, is independent of the permeability of that formation. The action of the fillers or plugging materials here is similar to that during lost circulation work in that the materials reduce the permeability of the section with which they come in contact. In this application, however, the fillers remain in place and are contained in the set plastic following the job. It is seen that their use affords the application of plastics in many wells where such application otherwise would be useless.

Selective Acidizing

In selective acidizing, the action of temporary plugging materials again is analogous to that of the materials for use in controlling lost circulation of drilling mud in that their action is entirely mechanical, reducing the permeability of the section with which they come in contact. (See Figure 1.) It is seen that, as acid is applied to a well, the rate of flow of the acid into any given section of formation is dependent upon that section's permeability with respect to the total open section. The area of least resistance to flow of the fluid, then, usually will get practically all of the acid and oftentimes this is not the area which it is desired to acidize. Surface plugging materials injected into the well, however, are carried to these highly permeable sections by their carrying medium, plate out and build up resistance to further fluid flow. This alters the permeability profile of the well, making the open section more equally resistant in all zones and helps to insure that the tighter zones are acidized.

Blanket Well Bottom

Another application closely related to selective acidizing is where it is desired to blanket the bottom of the well and thus prevent acidizing into bottom water. In this application it is seen that, as the injection pressures are raised above formation pressures to inject the acid into the formation, this pressure often is sufficient to force the blanket material out into the formation and thus leave the way open for the acid to follow. An addition of the suitable temporary plugging materials to this blanket material will halt penetration of the blanket into the formation. Following completion of the job and a reduction of the pressure within the well bore to less than that within the formation, the normal flow of fluid from the formation will remove the surface plugging materials. The bottom of the well then is open and retains the same permeability that it had before acid treatment of the well.

New applications for surface plugging materials continue to be recognized, their use allowing the performance of many remedial operations which otherwise would be economically unfeasible.

A typical example of the application of this technique is shown in Figure 2. In this operation Zone A was completed for several million cubic feet of gas. While attempting to complete Zone B with acid, channeling occurred. Zone B was temporarily blocked off by using inert filler suspended in 50 viscosity drilling mud. Pipe was perforated at point P; the channel from A to C was chemically cleaned and scoured with sharp inert fillers suspended in heavy acid. Plastic was then used to seal channel between A and C. Production packer was set at point Y for dual completion.

Many barrels of drilling mud and many gallons of plastic are saved every day through the use of these materials. Also the number of first-time successful squeeze jobs is steadily being raised through the use of these materials. Too, there is no way of knowing how many additional barrels of oil have been recovered through the use of these materials in selective acidizing work. In all of these operations, however, as in future applications yet to be recognized, the role of the surface plugging materials is of prime importance, a prerequisite for a successful job.

Integrated, Submersible Drilling Barge

■ CONTINUED FROM PAGE 122

above the quarters, draws air through automatic-type shutters from the galley and the tool pusher's room.

The interior bulkheads in the quarters are finished in two shades of green, the ceilings in white. Projected-type steel sash with insect screens is used throughout.

All floors are laid with asphalt tile except in the toilet and shower compartments, which have ceramic-tile flooring. Checker plate is used outside the quarters. A hot-water tank heated with bottled butane gas serves wash basins and showers.

The galley is equipped with sink and cabinets of stainless steel, stove, and refrigerator.

Portable water is delivered by gravity flow from a 900-gallon tank installed between the roof trusses of the house, and supported on stanchions located within the partitions. Chilled drinking water is supplied from refrigerated fountains conveniently located.

The barge is made of regular ABS hull steel, with 3/8-inch bottom and side shell with 5/16-inch deck plates. A two-foot walk, with storm rail along both the tanks and the sea wall, runs around the entire main deck. On both sides is a full-length double fender made of extra-heavy, split 8-inch pipe, welded to the hull. Eight bitts, two at each end and two on each side, are providing for towing and mooring. Two 27-foot spuds, one on each side, are used in anchoring. These are housed in water-tight trunks and can be driven down 16 feet.

All closed compartments are fitted with 18-inch manholes with water-tight covers, for access by vertical ladders. Wide and comfortable steel stairways with non-skid steps are arranged to give easy access from the main deck to the various levels.

A separate, high-capacity ballast pump of 90,000 gallons per hour capacity is used in raising the barge. With this pump it is possible to raise the barge from fully submerged position to minimum draft in 40 minutes. In addition, the slush pumps may also be used for this purpose, independently of or in conjunction with the ballast pump.

The keel of the Gulf Coast No. 1 was laid Oct. 22, 1948, and the hull, with the superstructure completed, was launched Jan. 5. On Feb. 19 the completed barge was delivered to the owners. It represents an important addition to the existing drilling-barge fleet, and its performance will undoubtedly be watched with great interest by all connected with marine drilling operations.

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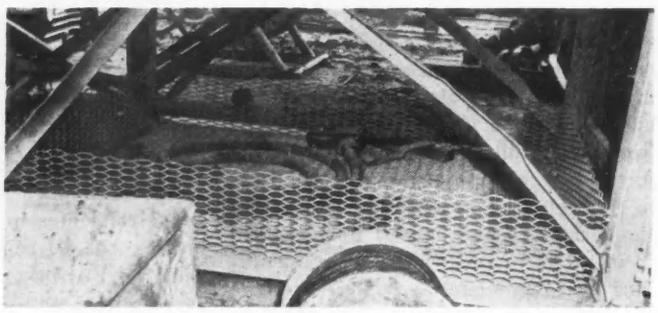
HOW TO—Transport Miscellaneous Drilling Equipment Items



When drilling rigs of 10,000-foot capacity or larger are moved, there is an urgent need for bins and cradles in which to transport miscellaneous items of drilling equipment. Small connections, pipe fittings, hydraulic and air hoses, adapters, and other small pieces of equipment that are easily lost during moving must be carefully stored in containers.

One tool pusher utilized every available space for such moving purposes, even to including a fabricated bin in the loading ramp, as illustrated. Since the structural loading ramp was moved as one unit, and was always loaded onto trucks in an upright position, the bin could be added conveniently and inexpensively to the framework of the ramp. Galvanized expanded metal was used to enclose the bin as shown. Bottom of the opening was cross-braced, and expanded metal was tack-welded the full width of the ramp. Side pieces about 12 inches high were added to make the enclosure.

During rig moves, many miscellaneous items, particularly rubber hose, including water hose, hydraulic hose, and other pieces that are easily damaged during shipment, are placed in the bin. The ramp is then loaded and moved to the next location, where these odd pieces are available when needed during erection of the rig.

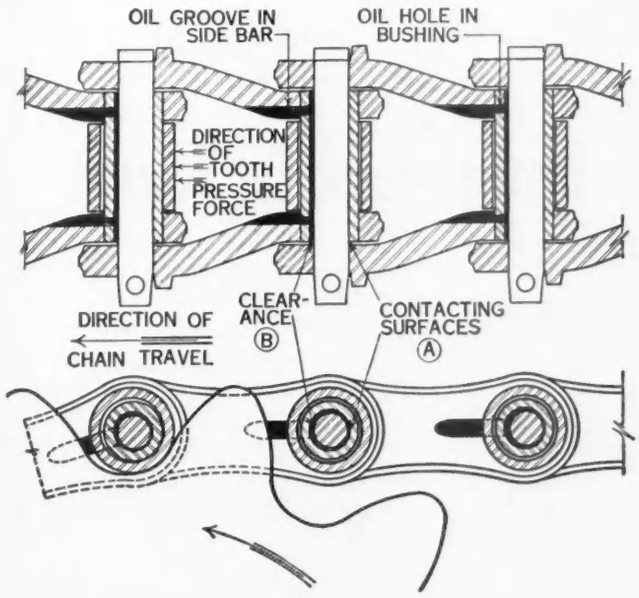
HOW TO—Unitize Equipment for Conditioning Drilling Mud

Unitized mud conditioning equipment has facilitated handling the drilling fluid during the course of operations at minimum expense and effort. Where all the elements of the mud-treating system are grouped together, the derrickman or mud engineer can better carry out any given conditioning program than in the case where they are not centralized.

Such a unitized installation is shown, with all the elements grouped in line from the mud receiver box to the shale pit. The shale shaker, chemical container and mud receiver are mounted on a pipe framework fitted with four-inch pipe skids. The receiving box is made from sheet metal and measures appromimately four feet wide, ten inches deep and 15 feet long. The shale shaker, mounted at the extreme left end of the pipe skid, is somewhat lower to receive a continuous flow of mud through the receiver box. The chemical container, welded to the upper edge of the receiver box is of the same width as the box, about 30 inches deep and 10 feet long. Enough chemicals, usually quebracho and caustic soda, can be mixed in the contained to last for three complete tours. The container is fitted with a regulating valve to govern the rate of flow.

An elevated board walkway separates the mud-treating equipment from the testing rack on which are mounted the necessary instruments to determine the characteristics of the drilling fluid. This handy assembly permits the derrickman or mud engineer to handle the mud treating job in workshop fashion, everything being right at hand and at waist height.

Here is WHY LINK-BELT API-4 Hyper Chain *Outlives other Drilling Chains*



Single link and cross-section drawing of Link-Belt API-4 Hyper Chain, with arrow to oil groove.

One of the secrets of a Link-Belt drilling chain's longer life is a small, insignificant-looking groove. You'll find this groove on the inside of each side-bar on every link of API-4 Hyper chain built by Link-Belt.

That tiny groove is mighty important—*and it's exclusive*—for it's patented by Link-Belt.

As API-4 Hyper drilling chain drives through the oil, the oil is literally scooped into that small groove . . . then flooded into the minute clearances between the *moving parts* of each link. Thus, Link-Belt chain *actually rides on a film of oil*—and continuously does it. Simple? Yes, but *exclusive* with Link-Belt—and worth remembering when you buy drilling chain again!

Which proves once more . . . it's the small, sometimes unnoticed things that Link-Belt does—which are just as important as the more obvious features—that build *longer life with less maintenance* into Link-Belt chains.

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Drilling Hints

Drilling contractors have long found that it pays to standardize on Penberthy products because of their exceptionally rugged construction and their dependable performance under the most severe operating conditions.

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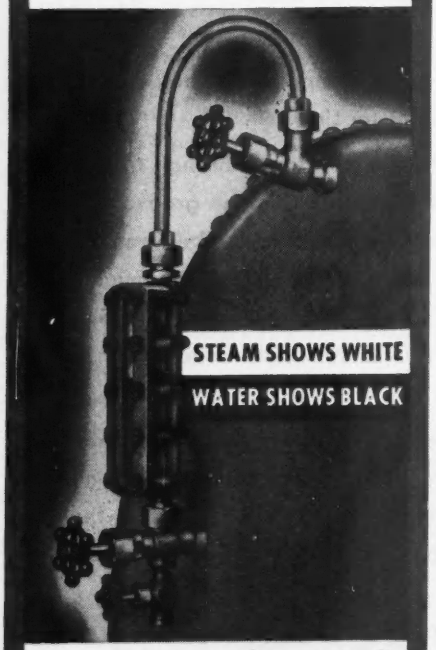
Penberthy Automatic Injectors are the accepted method of assuring an uninterrupted supply of feed water to boilers at minimum cost. They are quickly and easily installed—require little attention.



PENBERTHY "Reflex"
WATER GAGE SET

Water level cannot be misread because steam always shows white and water black. U-Bolt construction permits replacing glass by simply removing nuts on face of gage . . . unnecessary to work between gage and boiler. 3277-D

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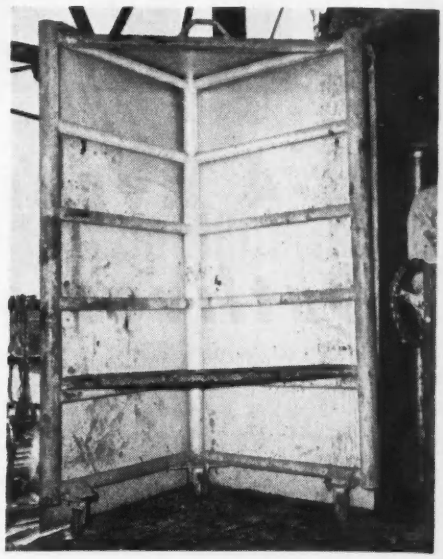
HOW TO—Build Portable Heater for Driller



Comfort for the driller when he is forced to remain beside the controls is provided by one drilling company. An inexpensively-built steam heating device mounted on rubber-tired casters is set up near the drawworks controls, and incoming steam and exhaust lines are fitted with swing joints to facilitate minor shifting of the unit as necessary.

Measuring approximately four feet on each side and about eight feet tall, the heater is made by welding two and three-inch piping into two panels, each at right angles to the other, forming a triangular area across which a 2 x 12-inch plank may be set up to provide seating for one or two men. The back sides of the two panels are covered with light sheeting to lend additional protection from outside weather and to help focus the heat where needed.

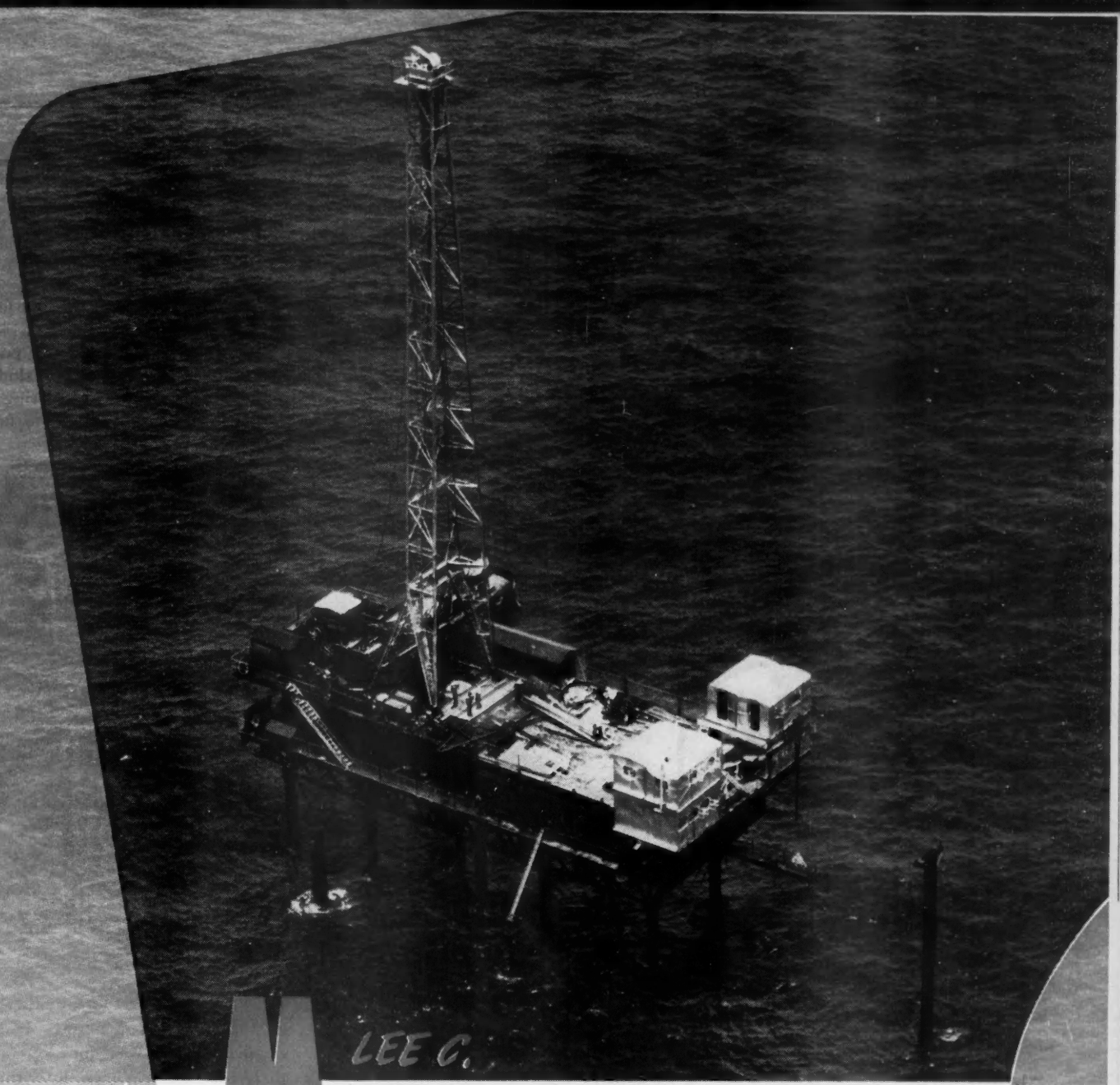
Moving the unit from one location to another is comparatively simple. It is only necessary to disconnect the inlet and outlet lines, then trundle the unit out to the edge of the floor where a light crane can lift it aboard a truck.

HOW TO—Slow Derrick Escape Car Descent

To slow the descent of the escape car on which the derrick man can ride to safety in the event of a fire or blowout, one company has adopted the use of a counterweight device which is both simple in design and which can be installed easily at each location.

Rigged up on a separate three-eighth-inch line, the latter anchored out beyond the immediate rig area, the weight consists of a 4½-foot length of 6⅝-inch casing which is closed off at one end, and to which is welded a pair of lubricated sheaves which ride on the cable. The pipe section is filled with pieces of scrap iron or concrete fragments until the total weight of the unit comes to slightly less than the weight of the average derrickman and the car itself.

A single bolt is run through the open end of the pipe to prevent the weights from bouncing out when the unit returns to its normal position. A length of one-fourth-inch wire line run over a pulley slung on the side of the derrick, connects the escape car to the bail of the counterweight. A bumper made of a discarded or worn heavy rubber gasket or drill pipe protector is spiked to the bumper post in the manner shown to lessen the shock of stopping the returning weight box when it strikes the post.



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Lee C. Moore is providing a large portion of the masts and derricks used in deep water drilling. Thus, Lee C. Moore's progressive service, with forty years experience in building derricks and accessories, is paying off in successful operations wherever their equipment is being used.

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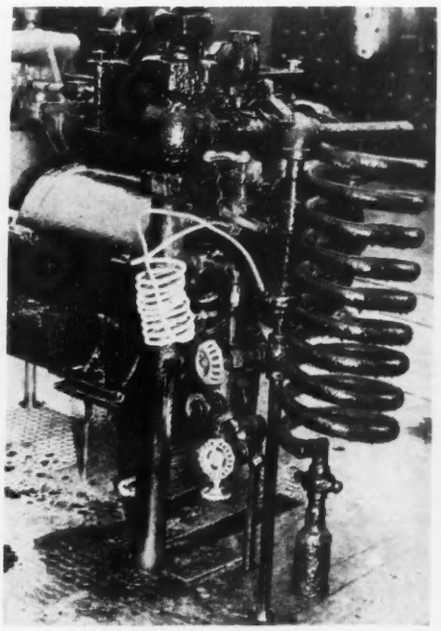
HOW TO—Actuate Flow of Lubricant to Engine Steam Line

The widely-accepted and commonly-used "nigger boy" type steam lubricators take advantage of gravity flow of the lubricant into the steam line leading to an engine or pump. When the lubricant container is mounted horizontally below the boiler feed water pumps, and also below the point of entrance into the steam line, the problem of feeding the lubricant into the line becomes involved. A simple and practical solution is illustrated.

The cylinder containing the lubricant was welded to the skid on which was mounted the boiler feed water pumps. It was located alongside the skid beam runners, and below the flooring of the unit. In order for lubricant to flow into



the steam line, pressure in the line and in the lubricant container had to be equalized. This was done by tapping a three-fourths-inch pipe into the steam line and feeding it to the top of the lubricant container. A one-half inch pipe extended through the lubricant container to draw the lubricant off the bottom of the container. It extended through the steel plate flooring and connected to a flow indicator equipped with a window. The lubricant line was then tapped into the steam line just before the steam entered the feed water pumps.

The black coil of three-fourths-inch pipe shown at right is the steam pressure equalizing line connected to the steam line and to the top of the lubricant container. Steam condenses in the coils, thereby filling them with water. Since the top of the coils is about 12 inches higher than the point of entry into the steam line, there exists a small hydrostatic head. This head pressure is sufficient to force the lubricant into the line. The window in the lubricator shows the amount of flow which can be adjusted as desired.

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The MUDCO Mud Control Unit Offers a Fast and Positive Means for:

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2. Chasing Drill Pipe During Trips.
3. Preventing Backflow.
4. Adding weighting material with high pressure pumps.
5. Operational SAFETY on derrick floor—also reduces fire hazard while circulating oil or oil base mud.

SAVES:

1. Cost of weighting material often used on each trip to chase mud.
2. Wear and tear on equipment caused by raising and lowering pipe to chase mud.
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4. Mud.

Driller has fingertip control of compressed air (or steam) which may be directed to the mud control valve below the gooseneck or to the mud control cap when it has been screwed into the box of the stand to be pulled.

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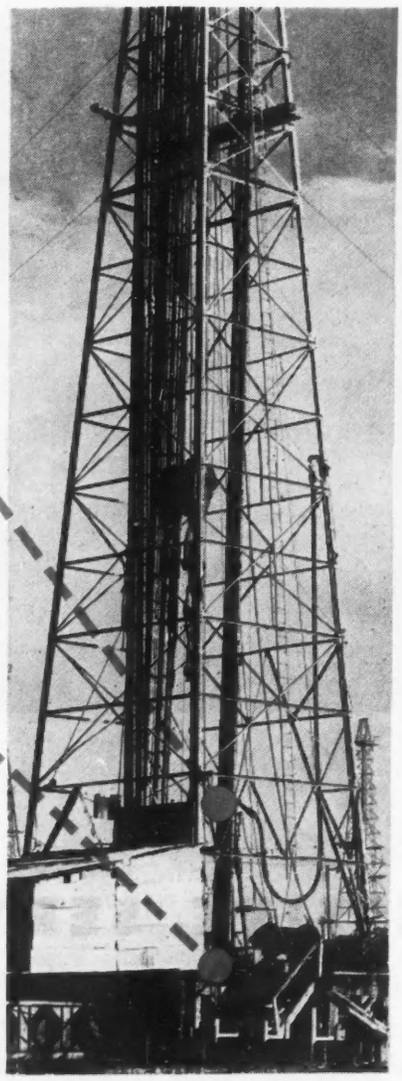

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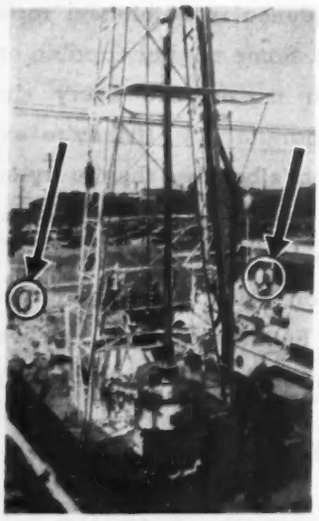

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To eliminate disadvantages of having fuel lines strung out around the derrick location and working areas, one company found it desirable to bury flexible lines and bring them all into a centralized and convenient point. For general all-around convenience in starting or stopping engines, or in the event of an emergency, any or all of the engines powering

pumps, drawworks or auxiliary units may be started or shut down quickly.

As shown in the illustration, the installation of the manifold is a simple one, as it is mounted at slightly above ground level and requires no special fittings beyond the usual couplings and stop cocks. The system eliminates the possibility of having the lines run over or cut by movement of heavy trucks or equipment.

HOW TO—

Heat Water for Boiler

The economy of heating boiler feed water with exhaust steam has long been recognized by operators of steam rigs faced with rising fuel costs. Among the many auxiliary functions performed by engine exhaust steam is that of heating the boiler feed water. Since feeding water into the boilers is a continuous process, it is necessary that the source of exhaust steam should also be continuous.

In the case illustrated, steam was taken from the steam-driven air jammer used in compressing air for lifting water

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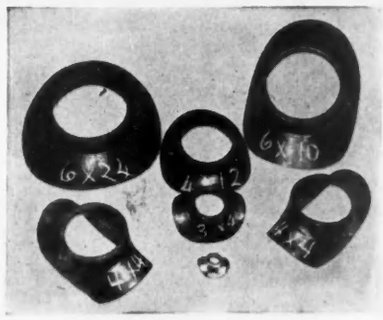

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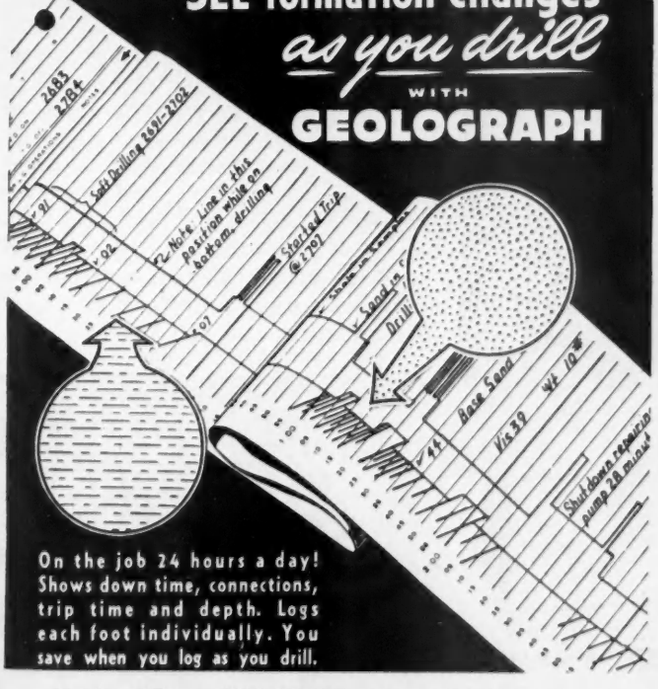

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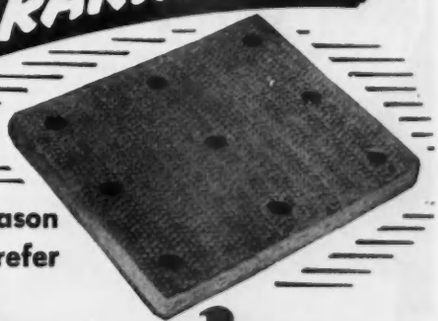

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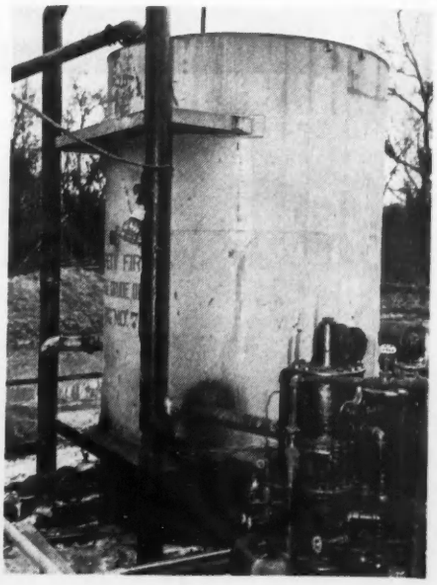
from a shallow water well and for operating air equipment around the rig. Sufficient air was required to maintain the air jammer in continuous operation.

Steam exhaust from the air jammer was piped to the tank into which the boiler feed water was pumped prior to entering the feed water pumps. The steam passed through three-inch pipe that made one complete coil inside the tank before passing into the atmosphere. The intake line may be seen welded to the tank about 30 inches from the ground. Exhaust from the tank is from a slightly higher point on the opposite side of the tank near the far skid runner of the tank.

Water is lifted by air into the top of the tank through the line shown. As the feed water pumps pick up the water, it passes around the steam coils near the tank's bottom and out the lower outlet equipped with a valve. The tank itself is a useful item, providing warm water to the feed water pumps at considerable head pressure. The tank is permanently equipped with four-inch pipe skid runners.



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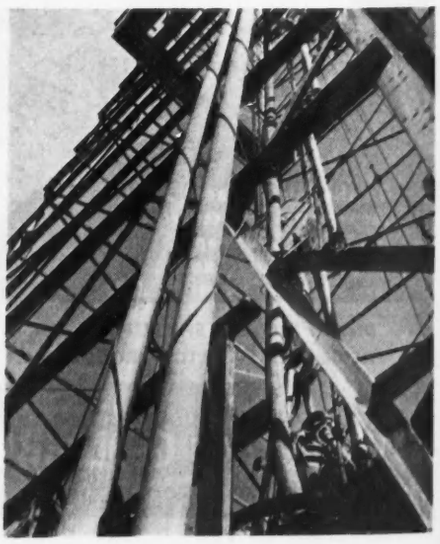
HOW TO—

Fix Derrick Standpipe

A quick method of lashing the standpipe to the outside of the derrick, one that requires no U-bolts or other form of rigid clamp, is employed satisfactorily by one company. Instead of the clamps, a length of sand line is wrapped around the pipe, and the line is laced around each girt of the derrick as shown. After the line is drawn down tightly, a weight is attached to the lower end to keep a constant tension on the line. The work involved in dismantling the standpipe when the rig is moved is reduced to a minimum with this simplified method of lashing.



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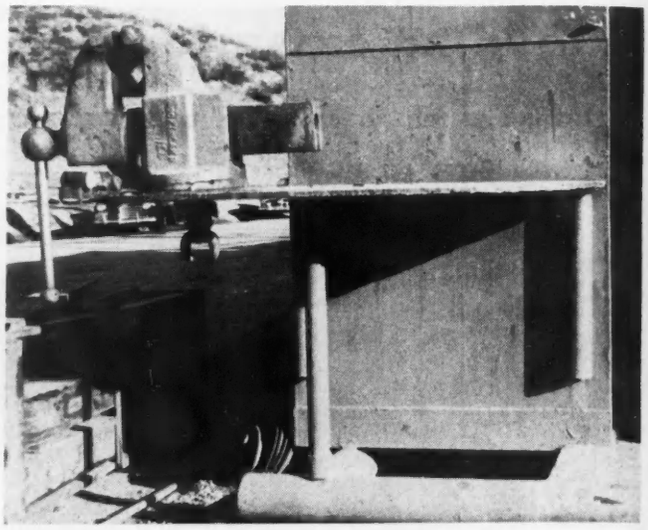
HOW TO—Make Mount for Combination Vise



Because the mount for a combination vise presented an objectionable and inconvenient projection when moving drilling equipment, a different type was devised. Instead of securely welding or bolting the frame for the mount to some part of the equipment, this newer mounting is as easily set up as to disconnect. As the toolhouse is an all-steel structure with substantial walls and foundation, the vise is connected to one end as near the door as practicable. The platform upon which the vise is installed is a triangular sheet of boiler plate steel, trimmed and finished to remove burrs. One side is fitted with heavy pins which will pass into two-inch pipe, while a standard, or leg, is welded near the corner where the vise is bolted to support the load while cutting pipe or doing other work where a vise is required.

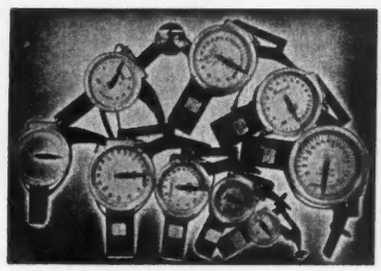
Ferrules of two-inch pipe are welded to the steel siding of the building to receive the heavy supporting pins, and a threadless collar is welded to the crosspiece of the foundation at the end of the building into which the two-inch pipe standard will conveniently fit.

HOW TO—Condition Field Gas

Whenever possible, fuel for the rig's boilers is supplied by connecting into the field's gas system, thereby effecting a considerable economy. In many cases, the field gas system is supplied by the lease separators in the field, the pressure being reduced to line operating pressure.

If the pressures are relatively high, and only one stage of separation is employed in the field, there will remain some condensate in the gas coming from the field separators. When the pressure is further reduced at the rig for use in the boiler burners, some of the liquid fractions will drop out and slug the burners. Past experience has shown that burning this liquid in the gas burners will clog them.

Such a condition was obviated by the installation of a shop-made separator which was permanently mounted on a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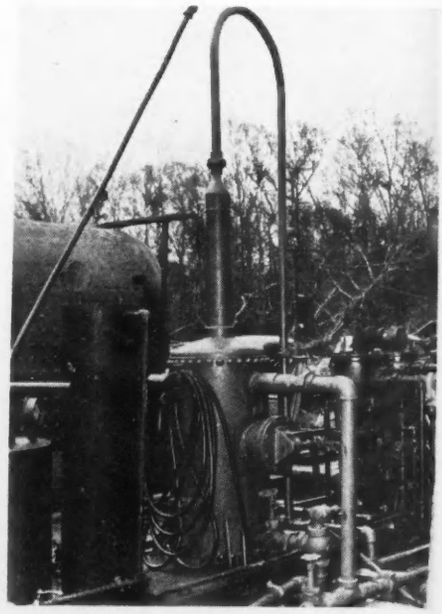
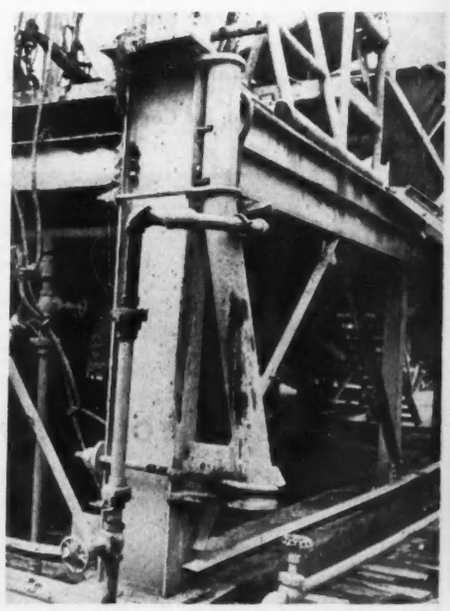
skid along with the air jammer and air pressure tanks. The separator operates on the same principle as the lease separator, with the exception of the intricate baffle system inside. It was made from plate steel and riveted to the top dome and bottom plate. An eight-inch riser was added at the top to which was connected the 180-degree bend of 2½-inch gas line leading to the burner regulating system. A float is located inside the separator to control the liquid level. The float actuates a dump valve mounted to the line connection at the bottom of the separator. When the liquid level rises to the half-way mark, the dump valve is opened, and the fluids are discharged from the separator by the line pressure. Field gas is piped into the separator at a point near the top of the chamber.



HOW TO—
Add Bumper to Derrick

When drilling field wells in relatively flat country where skidding the derrick is possible, considerable time can be saved in setting up and tearing down if the derrick is moved from one location to another along with the sub-structure. In making such a skid move, the drawworks is moved separately, but other pieces of equipment such as the rotary, the pipe tongs, automatic slips, and traveling block are left in position.

These remaining units are skidded with the derrick and the derrick sub-structure. A substantial load is represented by the above-mentioned pieces of equipment, and the problem of placing the skid



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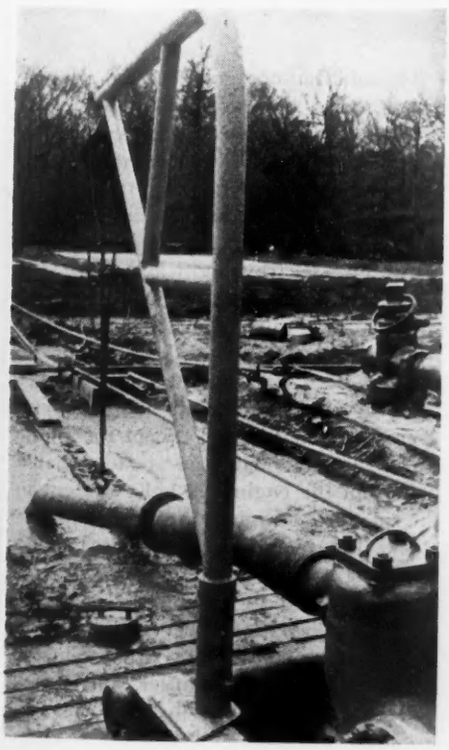
runners under the sub-structure is a big one. In lifting the derrick, sub-structure and attendant equipment, one difficulty lies in selecting an accessible point to place the derrick jack.

A simple and ingenious solution to this problem is illustrated. The derrick jack bumper was added to each corner of the derrick to facilitate lifting each side of the sub-structure and placing long skid runners under the foundation members. The lifting point was extended about 14 inches from the corner beam of the sub-structure, thereby making the jackknife operation safer.

A piece of six-inch pipe was used to make up the derrick jack bumper. A butt plate was welded at the top so that part of the plate extended under the derrick leg foot plate. Notches were cut into the pipe so it would fit closely to the corner beam. Bottom of the bumper was extended about 14 inches from the sub-structure by welding a half-inch butt plate to the pipe and reinforcing it with a similar piece at right angles to the butt plate.

HOW TO—
Support Suction Hose

Not many rigs incorporate the same method of suspending the mud pump suction hose over the mud pit. However, each new idea encountered on different rigs provides fertile material for the fabrication of the most efficient and least



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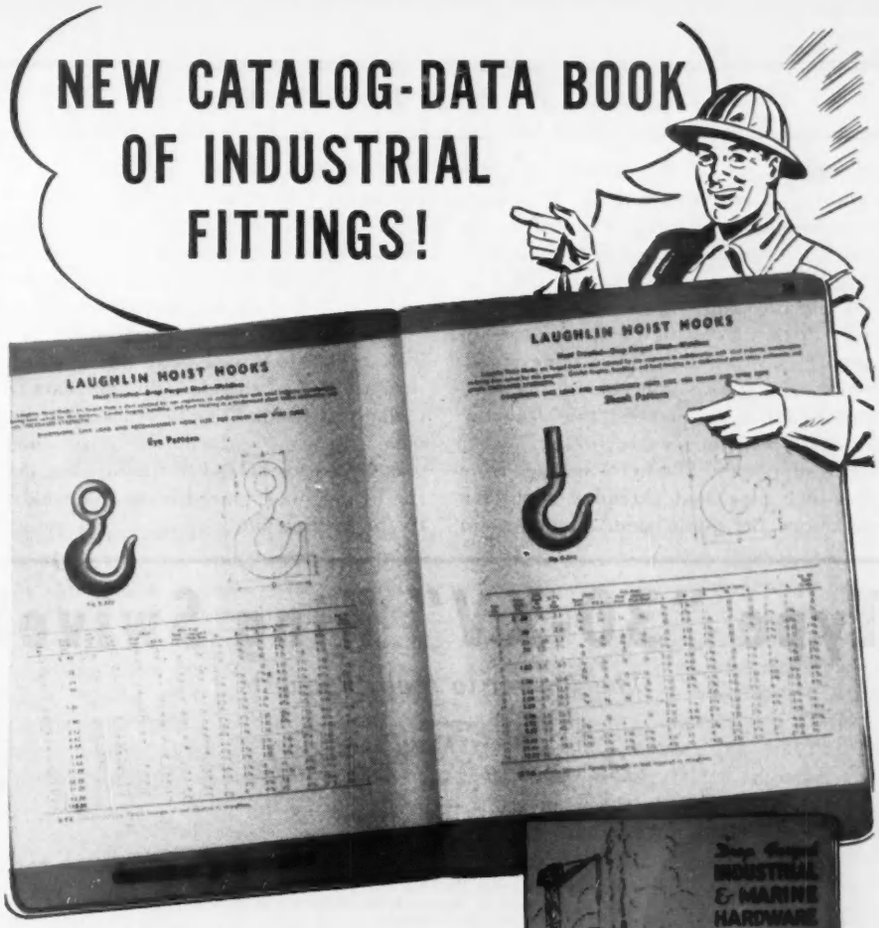

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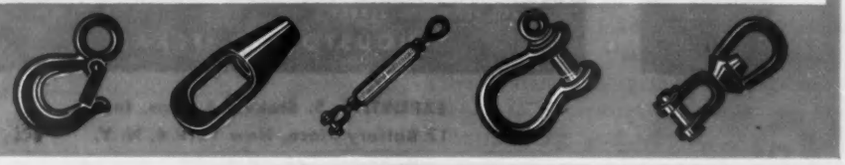

expensive type of suspension when revamping or assembling a rig. Providing suspension for the suction line over the mud pit quite a distance from the mud pump is the method illustrated.

While the point of suspension is relatively distant from the pump, the type of support is not bulky or over-designed. It consists of a vertically-mounted bracket and a chain hoist for adjusting the exact level of suction intake.

The supporting bracket was made from three-inch pipe, and extended about ten feet above the pump skid. At this point it was heated and bent so that the horizontal section extended approximately six feet from the vertical riser. It was cross braced and reinforced as shown.

This bracket was mounted on the mud pump skid in a 14-inch section of slightly larger pipe. This short section of pipe was welded to a base plate which was in turn welded to the skid runner beam. A collar was welded to the bracket to provide a bearing surface. The chain hoist was bolted to the end of the bracket, and the lifting hook placed in an eye welded to the suction line.

HOW TO—
Muffle Engine Exhaust

Heavy steam rigs operating near residential areas or in the immediate vicinity ot heavily-traveled highways and roads ofttimes form objectional noises or steam banks from the drilling engine exhaust. In some cases, there is sufficient complaint to cause the operator to take remedial steps. Faced with such a problem of objectional steam exhaust, one tool pusher devised a temporary muffler that has satisfied all parties concerned.

The muffler not only quieted the exhaust noises, but resulted in some condensation of the steam. However, the main purpose of the device was to lift the steam bank generated by the exhaust to a point well above ground level so the steam would not impair fast moving traffic on a nearby highway.

Engine exhaust was piped through a six-inch line to a point about 50 feet from the rig. Five steel drums were cut open at both ends and welded together to form a long cylinder. The two end drums were left closed except for a hole cut to accommodate the steam exhaust line from the engine. A hole was cut in the side of the far end drum to accept the stack. The temporary muffler was relatively light and force of the steam flow would cause it to lift and fall, thereby slowly moving it. To prevent this movement, four stakes were driven in the ground next to the muffler, and pieces nailed across the top to hold the unit in place.

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Factors Influencing Dynamometer Card Shape

By KENNETH N. MILLS
Assistant Chief Mechanical Engineer
Emsco Derrick & Equipment Company

THE shape of the surface dynamometer card obtained from a pumping well is a function of the surface operating conditions combined with sub-surface conditions. It reflects the range and magnitude of the loads imposed on the sucker rods, and can be used to improve the service life of the sucker rods and the surface machinery. As dynamically the sucker rod system is a problem in elasticity, sub-surface events do not occur concurrently with surface events, and the system is subjected to vibratory loads in addition to the inertia and static loads. The effect of the elastic nature of the sucker rod system on its dynamic characteristics will depend on the length of the rod string and the surface pumping speed. The vibratory characteristics of the system can be influenced by the mechanical characteristics of the surface machinery but they are not influenced by the sub-surface equipment. However, vibrations can be induced into the rod string by the action of either the surface or sub-surface equipment.

If it were possible to record only the static loads imposed on the rod string with 100 percent volumetric efficiency, the surface dynamometer card would have the general characteristics and shape shown in Figure 1. On the card it will be noted that the surface end of the rod string does not start to assume the fluid load until a time interval T has elapsed. Also, it will be noted that the same lag exists at the start of the down stroke. This time lag represents the time required for the surface motion to travel to the traveling valve and return to the surface. The minimum value of this time lag is represented by the equation:

$$T = \frac{V}{2L}$$

where: T = Time lag, seconds
V = Velocity of stress transmission in steel, feet per second
L = Length of rod string, feet

If the traveling valve does not respond to the motion of the rod string instantaneously this time lag will be increased by the amount of this delay. In practice it is doubtful if the response will be instantaneous, because gas and fluid compressibility will tend to create a small delay. A practical example of this ideal dynamometer card is shown in Figure 2. This card was obtained at six strokes per minute. The dynamometer card shown in Figure 3 illustrates the effect of increasing the pumping speed to 11 strokes per minute. It will be noted that increasing the pumping speed caused a drastic change in the shape of the dynamometer card.

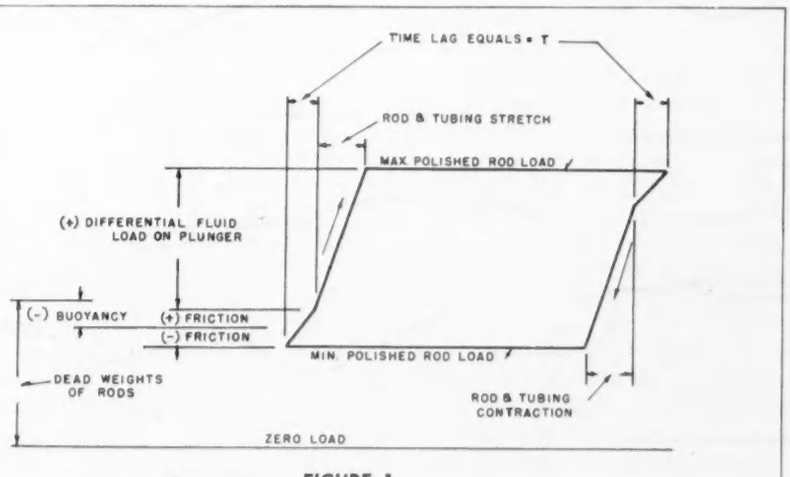

FIGURE 1

It has been shown by several investigators 1, 2 that this drastic change in the shape of the dynamometer card is the result of longitudinal vibrations in the sucker rod string. Also, it has been shown that in the case of wells pumped with walking beams these vibrations are induced by the opening and closing of the traveling valve. The truth of this statement is illustrated by the dynamometer cards shown in Figures 4 and 5. The card shown in Figure 4 was obtained from a well which was being pumped at the rate of nine strokes per minute with the rods parted at the plunger. The card shown in Figure 5 was obtained on the same well with the rods attached to the plunger.

The vibratory system of an oil well consists solely of the rod string and in the case of a well being pumped with conventional equipment, it can be analyzed as a steel rod fixed at the surface end and subjected to a suddenly applied force at the free end. If the suddenly applied force is the closing of the traveling valve, it will induce a tensile wave into the rod string. This wave will travel to the surface at the speed of stress transmission in the rods. When it reaches the surface, it will be reflected as a tensile wave and will travel to the plunger. At the plunger it will be reflected as a compressive wave, and this compressive wave will be reflected from the surface end of the rod string as a compressive wave. Thus a vibratory wave is induced into the rod string.

In the case of the opening of the traveling valve a compressive wave will be induced into the rod string and it will follow the same process. As will be shown later, vibrations can be induced by sudden applications of force at the surface end of the rod string. Also, the mechanical characteristics of other pumping systems can alter the dynamic characteristics of the rod string. In all cases the fluid load acting on the plunger does not alter the natural frequency of the system, but acts as a damper and tends to damp out the vibrations existing in the rod string. The general

equation for the frequency of the vibrating system is

$$f = \frac{N}{4L}\sqrt{\frac{E}{d}} = \frac{NV}{4L}$$

where: f = Frequency, cycles per second

N = 1, 2, 3, ——

L = Length of rod string, feet

d = Density, mass per unit volume

E = Modulus of elasticity of material in rod string

V = Velocity of stress transmission in rod material, feet per second

This equation indicates that the system has an infinite number of natural frequencies, any of which might become resonant with the pumping motion. Due to the fact that the damping forces existing in an oil well are rather large and the higher frequencies are quite removed from the maximum practical forced frequency, only the lowest frequencies should be considered. Considering the lowest frequencies, and assuming the rod material to be steel, the natural frquency can be expressed by the equation:

$$f = \frac{237{,}000}{L} \text{ cycles per minute}$$

A thorough understanding of how vibrations combine and the effect of damping on the amplitude of vibrations is necessary to visualize how they affect the shape of the dynamometer card. If a system which is vibrating at a constant amplitude has a second train of vibrations of equal amplitude induced into it exactly 180 degrees out of phase, the two vibrations will cancel each other as shown in Figure 6. The extreme opposite of this condition would be to have the second vibration exactly in phase with the first vibration. The result of this condition would be a vibration of twice the amplitude of the original vibration, as the two vibrations will add. Between these two extremes, there are an infinite number of manners in which two or more vibrations can combine. In each case the amplitude and phase angle are changed as shown in Figure 7, but the frequency is unchanged.

As damping forces exist in an oil well, their effect on the nature of the vibrations must be considered. If a vibration is induced into the rod string, it will persist until its energy is dissipated through friction. The effect of viscous damping on a vibration is shown in Figure 8. In this illustration it will be noted that the amplitude is gradually diminished, but the frequency is not affected. Damping is an important factor in determining the shape of a dynamometer card because it determines how long the vibrations will persist. If the first series of vibrations has not been dissipated by damping when the second series is induced into the rod string, the two series of vibrations will combine. The phase angle between the two vibrations will determine the effect of this combination on the amplitude and phase angle of the resultant vibration. If the vibrations are opposed, one half the stroke cycle may be practically free of vibrations. The dynamometer card in Figure 9 illustrates this condition. The dynamometer card in Figure 10 shows the characteristics developed when the two trains of vibrations are practically in phase.

In the case of a dynamometer card taken on a well pumped with a conventional pumping unit, the vibratory wave as recorded will not be a sine wave, but will appear distorted due to the nonuniform velocity of the polished rod. Typical polished rod velocity and acceleration curves for a conventional pumping unit are shown in Figure 11.

From this curve it is apparent that the polished rod velocity varies over wide limits and is constantly changing. Also, it will be noted that the rate of acceleration varies over wide limits and the rate of change in the rate of acceleration is gradual. As the rate of change in acceleration is gradual, the forces imposed on the rod string by acceleration are gradually applied and do not induce vibrations into the rod string.

As vibrations are induced into the rod string by the opening and closing of the traveling valve, it is reasonable to expect the action of the pump to have a controlling influence on the intensity of the vibrations. If the well is producing a gaseous fluid, the gas entrapped in the fluid will cause a reduction in the rate of load transfer between the rods and tubing. This reduction in the rate of load transfer will reduce the intensity of the impulse produced by the load transfer and this will influence the intensity of the vibratory loads. The magnitude of this reduction will be small when the load is transferred from the tubing to the rods. When the load is transferred from the rods to the tubing this reduction can be quite large, because gas can be compressed during this phase of the pump action. If gas is compressed it will cause a gradual shift in the load. If the magnitude of this reduction in impulse is sufficiently large, the vibratory wave thus produced will be damped out before it reaches the surface.

The possibility of having the disturbing force in synchronism with the vi-

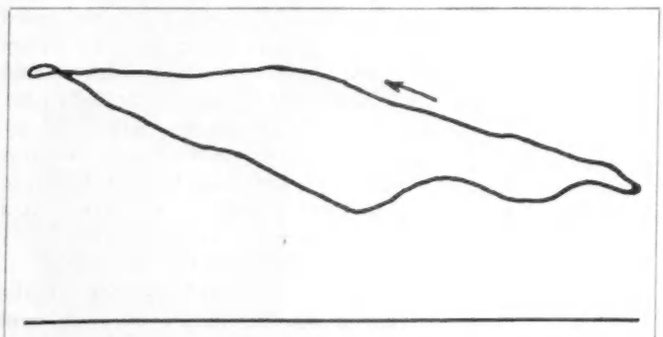

FIGURE 2

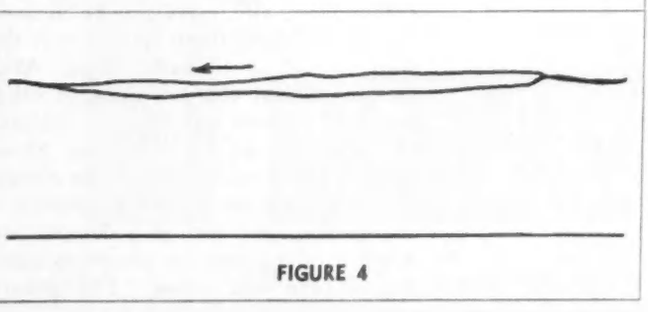

FIGURE 4

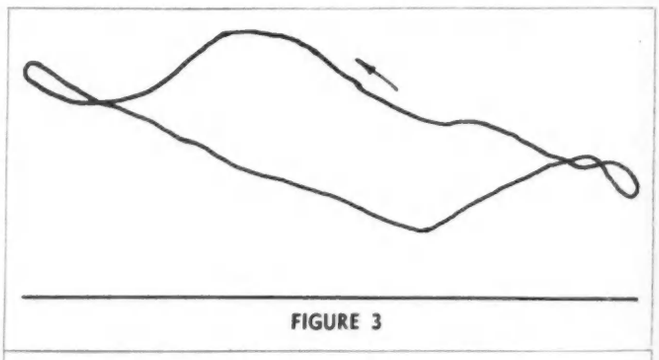

FIGURE 3

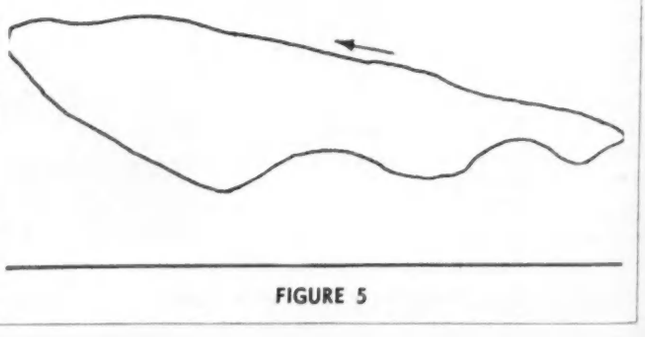

FIGURE 5

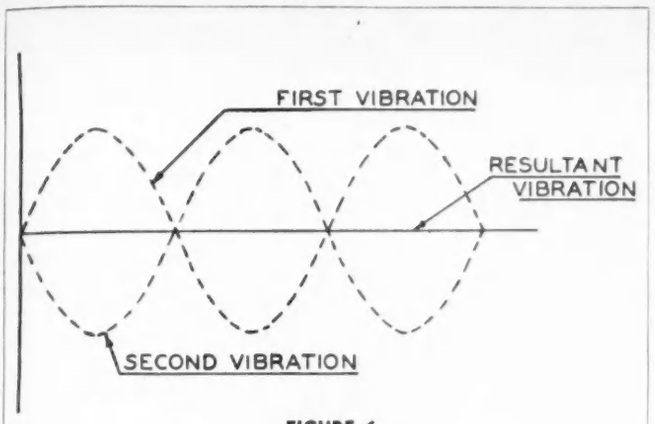

FIGURE 6

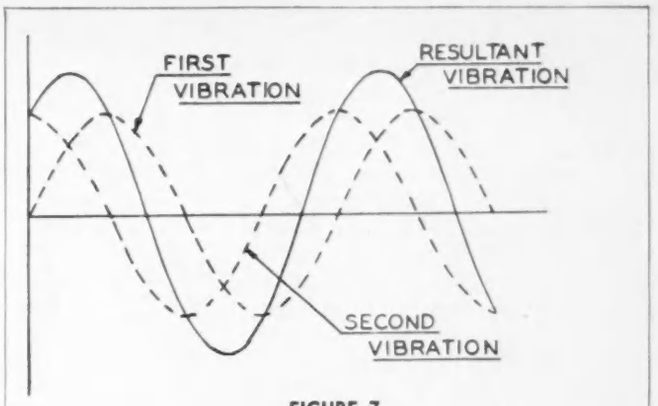

FIGURE 7

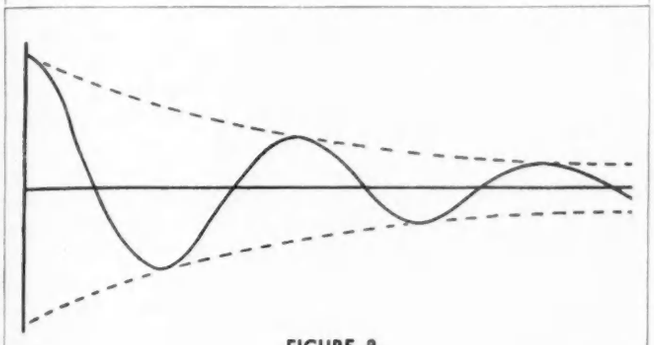

FIGURE 8

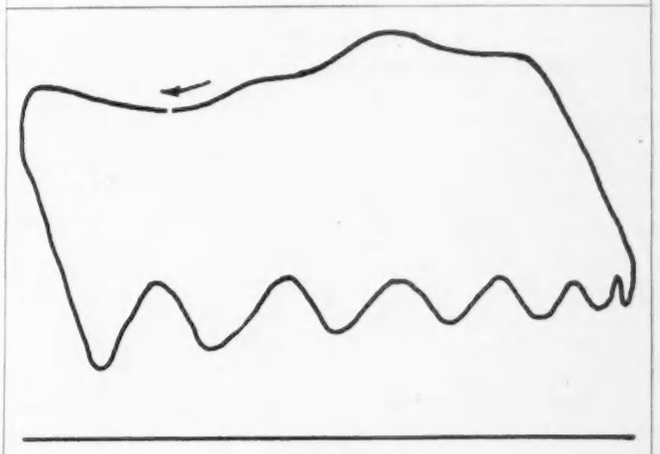

FIGURE 9

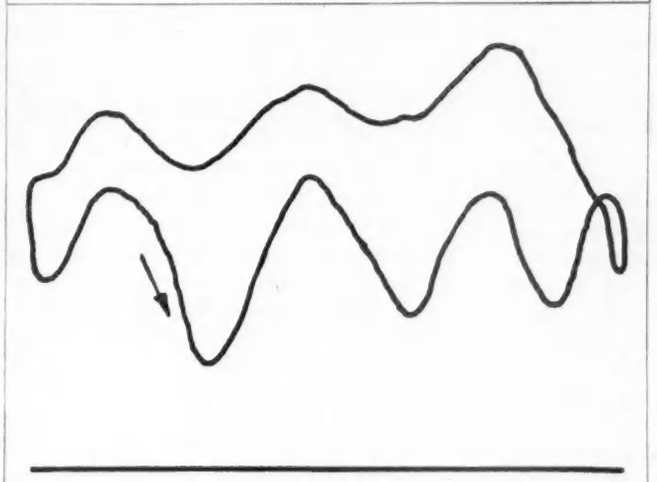

FIGURE 10

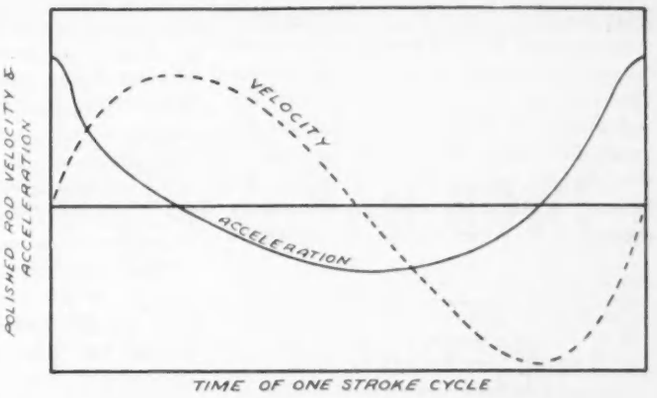

FIGURE 11

brations in the rod string is greatest in a well whose rod string has only one train of vibrations induced into it per stroke cycle. In a well of this type, the force inducing the vibrations recurs after approximately equal periods of time, and differences in the time required to execute the lift and drop portions of the stroke cycle will not tend to cause conflicting vibrations. If the rod string is subjected to two disturbing forces per stroke cycle, the possibility of each of the forces being synchronous with the vibrations existing in the rod string is materially reduced.

For the forces to be synchronous with the vibrations the time required to execute the two halves of the stroke cycle would have to be exactly equal. Also, the possibility of having the two trains of vibrations exactly in phase with each other is remote. As we have damping, the severity of the vibrations when the disturbing force is synchronous with the vibrations will depend on the ratio of the natural frequency of the rod string to the frequency of the disturbing force. The severity of the vibratory loads will increase as this ratio approaches unity. In the case of a well with only one impulse per stroke cycle with a frequency ratio of two, the polished rod will travel approximately half the lift stroke before the closing of the traveling valve is recorded at the surface. The closing of the traveling valve will be recorded as an increase in polished rod load. The development of the vibrations in a well of this type is shown in Figure 12-A. The effect of doubling these vibrations back to conform with the conventional dynamometer card is shown in Figure 12-B. The fluid and inertia loads will cause the actual dynamometer card to assume the general characteristics shown in Figure 12-C. This same development can be used to explain the shape of dynamometer cards for other pumping ratios.

The above outlined development is applicable to conventional walking beam pumping units. However, it may not be applicable to some long stroke pumping units which are designed to produce a constant polished rod velocity. The mechanical characteristics of some of these units cause a fundamental change in the manner in which the vibrations are re-

corded. Also, the nature of the surface motion can change the nature of the forces inducing vibrations into the rod string. As the polished rod velocity is constant instead of variable, as is the case with a walking beam pumping unit, rod vibrations will be recorded undistorted. Also, the time lag between the start of the up and down portions of the stroke cycle and the opening and closing of the traveling valve will be more apparent, because of the high rod velocity at the ends of the stroke. If the rate of surface acceleration is high, it can impose forces on the rod string which will induce vibrations into the rod string. These vibrations will originate at the surface and will combine with those induced by the valve action. If the rate of surface acceleration is low, the intensity of these forces will be low and they will not induce vibrations into the rod string. However, this will not affect the vibrations induced by the pump valve action.

The development of the lift portion of a constant velocity pumping unit dynamometer card is shown in Figure 13. The upper portion of this illustration shows the velocity and acceleration characteristics assumed for the pumping unit. It will be noted that the velocity was assumed to be constant except at the end of the stroke, and the acceleration at the end of the stroke was assumed to be constant. When this constant rate of acceleration is imposed on the rod string, it will impose a sudden increase in tensile force on the rod string. If this force is sufficiently great, this wave will be reflected from the plunger end of the rod string and become a vibratory wave as shown by the curve B. When the rod string starts its upward movement this force will be transmitted to the traveling valve. The traveling valve will close, assuming the fluid load and when this force reaches the surface it will appear as an increase in load. This force wave will be reflected and become a vibratory wave as shown by the curve A. In this illustration it will be noted that the latter vibratory wave does not appear at the surface until a minimum time interval of one half period has elapsed. The phase angle between these two vibrations will depend on the mechanical characteristics of the pumping unit, and it is highly probable that they will never be exactly in phase or exactly opposed. In the lower part of this illustration these vibrations have been combined with the static loads to obtain the development of the beginning of the lift portion of the card. In these illustrations the intensity of the vibrations has been exaggerated for the sake of clarity.

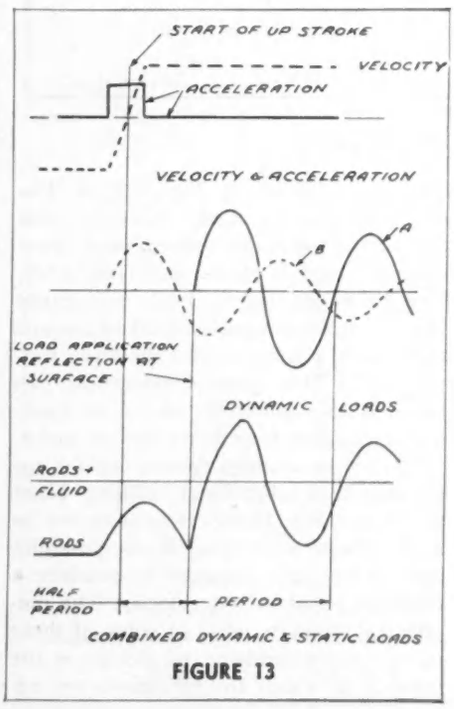

FIGURE 13

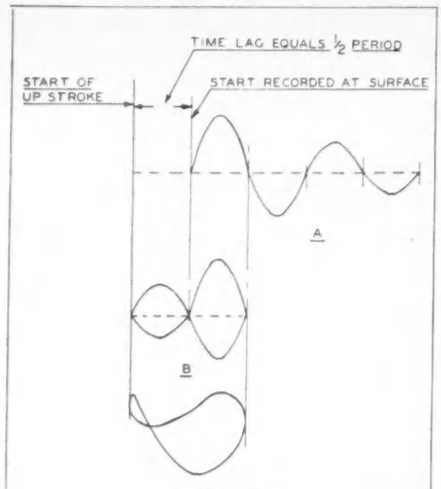

FIGURE 12

The development of the down stroke portion of a constant velocity pumping unit dynamometer card is shown in Figure 14. The upper portion of this illustration shows the velocity and acceleration characteristics assumed which are the same as those assumed for the lift portion of the stroke. When the constant accelerating force is imposed on the rod string, it imposes a compressive force on the rods. If the intensity of this force is sufficiently great, it will be reflected from the plunger end of the rod string and become a vibratory wave as shown by the Curve B. When the rod string starts its downward movement this force will be transmitted to the traveling valve, releasing the load, and when this force reaches the surface it will appear as a decrease in load. This stress wave will be reflected and it will appear as a vibratory wave as shown by the Curve A. Here again this vibration does not start until a minimum time lapse of one-half period. In the lower part of the illustration the effect of releasing the fluid load from the plunger has been considered to obtain the complete development of this portion of the dynamometer card.

In each of the sectional developments it has been assumed that the vibrations are completely damped out before the start of the succeeding portion of the stroke cycle. If this assumption is true, shape of the theoretical dynamometer card should follow the general shape shown in Figure 15. The number of vibration cycles recorded on each portion of the stroke cycle will be a function of the time required to execute the two halves of the stroke cycle. If this assumption is not true, the vibrations existing at end of one half of the stroke cycle will combine with those induced by the start of the new stroke cycle, and this combination will cause a distortion in the new train of vibrations. If these vibrations are in phase with the new train of vibrations, they will increase its intensity. If they are out of phase the intensity of the new train of vibrations will be decreased and the amount of this reduction will depend on the phase angle between the two trains of vibrations. Some actual dynamometer cards taken on wells pumped with long stroke constant velocity pumping units are shown in Figure 16. In each of these cards it will be noted that the effects of time delay are very apparent when compared with dynamometer cards taken on wells produced with conventional walking beam pumping units.

One of the early types of long stroke pumping units produced a very unusual dynamometer card, because it did not indicate the presence of vibratory loads. This unit has a variable but uncontrollable polished rod velocity. A typical dynamometer card taken on a well pumped with this unit is shown in Fig-

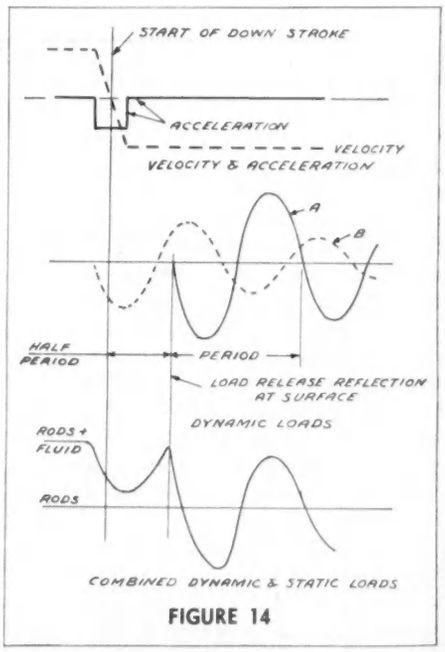

FIGURE 14

YOUR PUMPER IS A *Bigger* MAN NOW!

Free Pumping has increased the stature of your pumper and his importance to your organization. He has been made independent of outside help. He doesn't have to call in a pulling crew or service unit when he wants to surface the bottom hole pump. He just turns a valve.

The compact central plant, from which he regulates the pumping rate of each well and where he gathers all essential bottom hole information, further adds to his capacity for doing a better job. This centralized control reduces well spacing to 18 inches, which is equivalent to equipping your pumper with "seven league" boots. He can visit every well and not leave the header manifold. That gives him an opportunity for necessary maintenance work.

Yes, your pumper is a much bigger man today, if you are giving him Free Pumping equipment to work with.

Why not enjoy the operating economies and saving on equipment made possible by Free Pumping? Your local Kobe representative has some interesting facts to show you.

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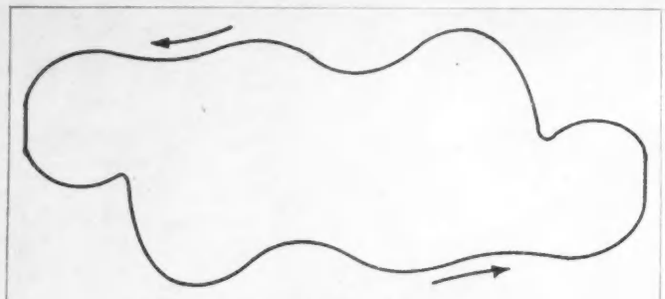


FIGURE 15

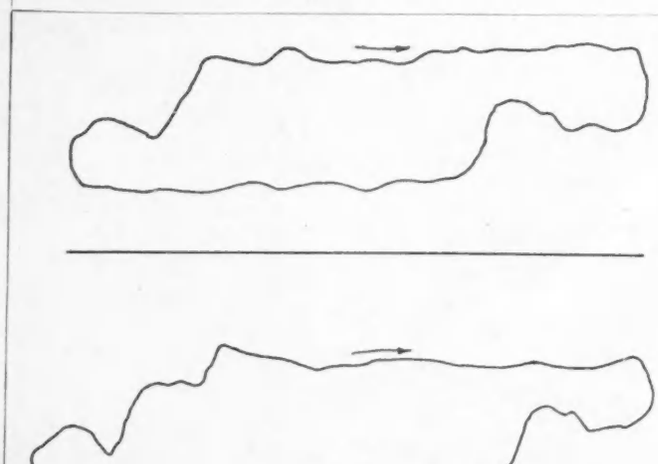


FIGURE 16 (Continued)

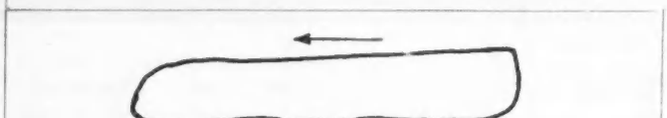


FIGURE 17

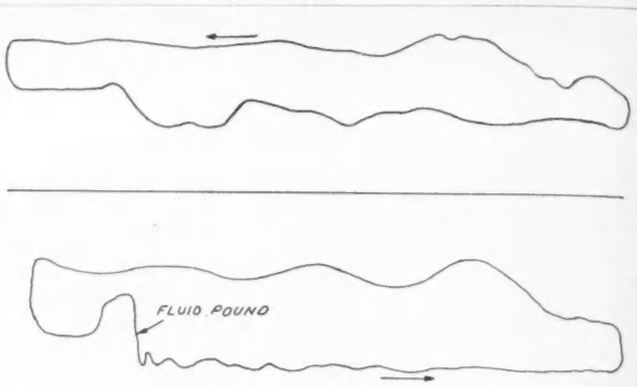


FIGURE 16

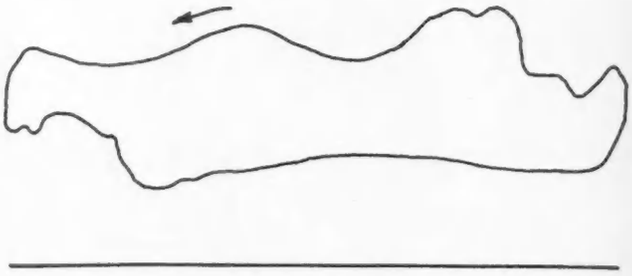


FIGURE 16 (Continued)

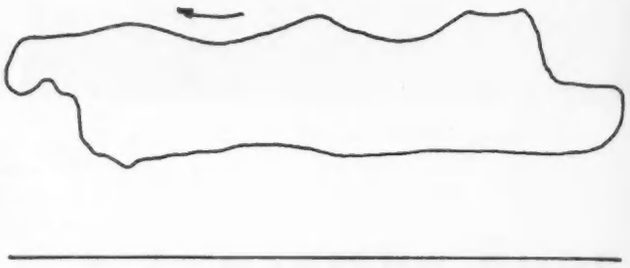


FIGURE 16 (Continued)

ure 17. The unit consists of a surface actuating cylinder which is operated with a constant pressure expansible medium such as gas or air. As the operating medium is expansible the polished rod velocity is very erratic. The use of an elastic connection between the rods and the power source at the surface completely changes the elastic nature of the sucker rod system. It causes all vibrations to be reflected 180 degrees out of phase with the results that surface end of the rod string is located at a node point. Thus the elastic connection between the power source and the sucker rods causes them to vibrate as a bar fixed at its center and subjected to an impulse at one of its free ends. The general equation for the frequency of this vibrating system is

$$f = \frac{N}{2L}\sqrt{\frac{E}{d}} = \frac{NV}{2L}$$

where f = Frequency, cycles per second
N = 1, 2, 3, ——
L = Length of rod string, feet
d = Density, mass per unit volume
E = Modulus of elasticity of material in rod string
V = Velocity of stress transmission in rod material, feet per second

If it were possible to take a dynamometer card in the center of the rod string of a well pumped with this type equipment it would show the same general characteristics as dynamometer cards from other long stroke pumping units. The vibratory load would be concentrated at this point, and vibrations would be recorded on the dynamometer card.

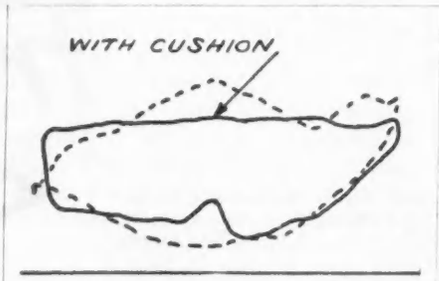


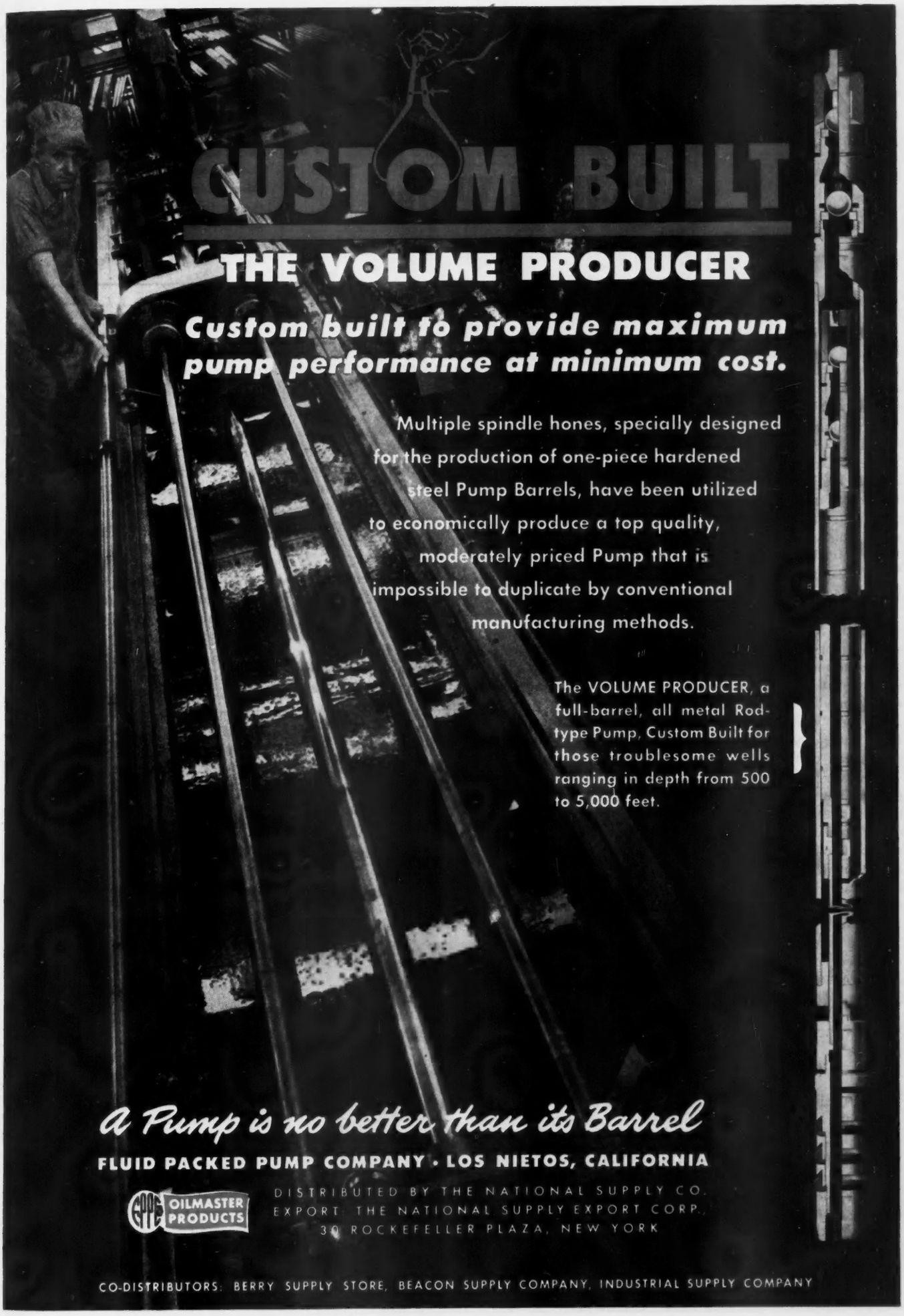
FIGURE 18

Numerous attempts have been made to gain the load smoothing effects of the elastic media driven pumping unit on conventional pumping units by introducing an elastic connection between the sucker rods and the walking beam. To be effective this connection must be very elastic, and it must respond instantaneously to change in polished rod load. The dynamometer card shown in Figure 18 was taken on a well fitted with one of these devices. This device provided an extremely elastic connection, and it will be noted that it produced a material reduction in the peak polished rod load.

BIBLIOGRAPHY

[1] "Vibration Problems in Oil Wells," by J. C. Slonneger, API Drilling & Production Practices, 1937.

[2] "Effects of Rod Vibrations on Dynamometer Cards," by Kenneth N. Mills and S. E. Corry, Oil Weekly, June 24, 1940.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Flooding with Re-Used Water

PROGRESSIVE USE of flood water from higher and depleted sands to lower and still productive zones is suggested as a means for obtaining the necessary volume, and at the same time avoiding the treating and purification operations which frequently are required when brine or other subterranean water reaches the surface and is exposed to air. This article is published by permission of the Chief, Illinois State Geological Survey.

By FREDERICK SQUIRES,
Petroleum Engineer, Illinois State Geological Survey,
Urbana, Illinois

THIS article describes a method of injecting the water from an upper flooded-out oil sand to flood a lower oil sand and so increase the percentage of oil recoverable.

This suggestion is based on a process described in Illinois State Geological Survey's Circular 101, "Oil-Field Flooding Streamlined for War," in which the writer advocated flooding an oil sand with water from a higher water-bearing sand. This was done successfully on the Basin McClosky where the McClosky "lime" was flooded with water from the Cypress sandstone.

The simplicity and the immediate success of the McClosky operation depended on the fact that the McClosky was so highly permeable that the Cypress water traversed it under static head. The same result may be expected under similar conditions, whether the upper sand contains natural water or water that was introduced to flood out oil.

However, if the lower sand is not pearmeable enough, the difference in head between it and the water from the upper sand will not develop enough pressure to flood the lower sand. Under this condition new pressure will have to be added, and it is here proposed that the additional pressure can be supplied by compressed air or gas.

There are many oil fields in Illinois that have several producing sands, all or many of which may be benefited by flooding. These fields include the old Lawrence County fields, New Harmony, Louden, Salem, and many others. So far the method used has been to flood the upper sands first, as at Siggins and Patoka. The Benton field may have floodable oil sands below the Tar Springs which is now about to be flooded. The Bridgeport sand in Lawrence County is being flooded ahead of the lower Kirkwood anad Tracey sands. In every case the flooded-out sand is apt to carry enough water to flood a lower sand.

The measured plan and section (Figure 1) shows a combination of three wells that were drilled to two sands, and the perspective drawing (Figure 2, Page 154) illustrates the method of using an old "five spot" in an upper flooded-out sand to flood a new "five spot" in a lower oil-producing sand.

Wells 1 and 3 (Figure 1) were water input wells, and well 2 was an output well in the upper sand. This sand has been completely flooded-out and is full of water. It is now desired to use the water to flood the lower sand. The first step is to deepen all wells to the lower sand and to case and run tubing or four-inch pipe on packers as shown in Wells 1 and 3, and to run a liner in Well 2. If the sand is highly permeable and the flooded out sand is considerably above the lower, part of the water in the upper sand may flow by gravity into the lower. If these conditions are not present in the proper degrees, then a source of increased pressure must be found. Air pressure through the annulus between the casing and tubing in Wells 1 and 3 provides the necessary extra pressure on the water-filled sand to force the water to enter Well 2 and to enter and traverse the lower sand at 2.

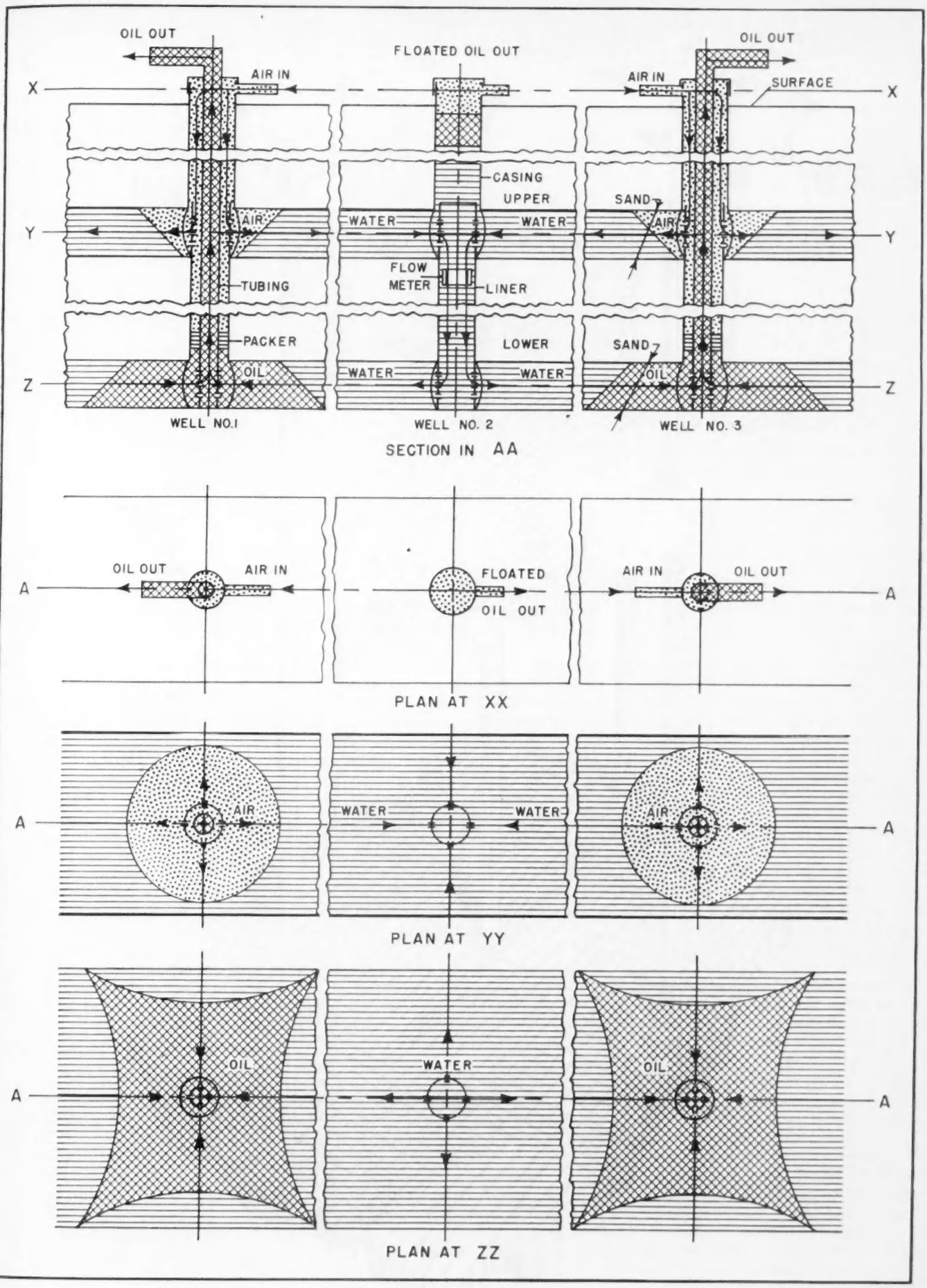
Well 2 is cased to the surface, which provides a long separating cylinder so that any oil or gas which may enter Well 2 will separate by gravity in the fluid column and may be drawn off at the surface. Well 2 and all repeat wells of this kind may be provided with flow meters so as to measure and control the amount of water admitted through them to the sand ZZ.

Because air is forced into the sand but is not withdrawn at any point, the total volume of air required will be small in comparison with the amount of air used in a repressuring operation in which air is withdrawn. Air pumped into Wells 1 and 3 cannot bypass the water while the sand is full or nearly full of water because the water would have no place to go. At first the air will displace water around Wells 1 and 3. Eventually of course, air will reach Well 2 but by that time most of the water will have been forced out of the upper sand into the lower. If more water is needed to complete the flooding of the lower sand it can be taken from water produced with the oil from Wells 1 and 3 and reinjected through tubing on a packer set above the lower sand in Well 2.

The cost of water is apt to be a large part of the total flooding expense. It is here suggested that the water injected into an upper sand may be used again in lower sands either under static pressure alone or combined with artificially applied air pressure.

About the Author

FREDERICK SQUIRES, petroleum engineer for the Illinois State Geological Survey, is credited with the first successful applications of repressuring and intentional water flooding in the Illinois oil fields. He holds degrees from Williams College and the School of Mines of Columbia University. He formerly was partner and field manager of Squires Brothers, Remlik Oil Company and Dinsmor Oil Company, which were organized at the inception of secondary recovery. He has invented several oil field processes and has contributed a number of technical papers on petroleum engineering.


OIL OUT
AIR IN
FLOATED OIL OUT
OIL OUT
AIR IN
SURFACE
X
X
CASING
UPPER
SAND
Y
AIR
WATER
WATER
AIR
Y
FLOW
METER
LINER
TUBING
PACKER
LOWER
SAND
OIL
WATER
WATER
OIL
Z
Z
WELL NO.1
WELL NO. 2
WELL NO. 3
SECTION IN AA
OIL OUT
AIR IN
FLOATED
OIL OUT
AIR IN
OIL OUT
A
A
PLAN AT XX
AIR
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WATER
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PLAN AT ZZ

FIGURE 1

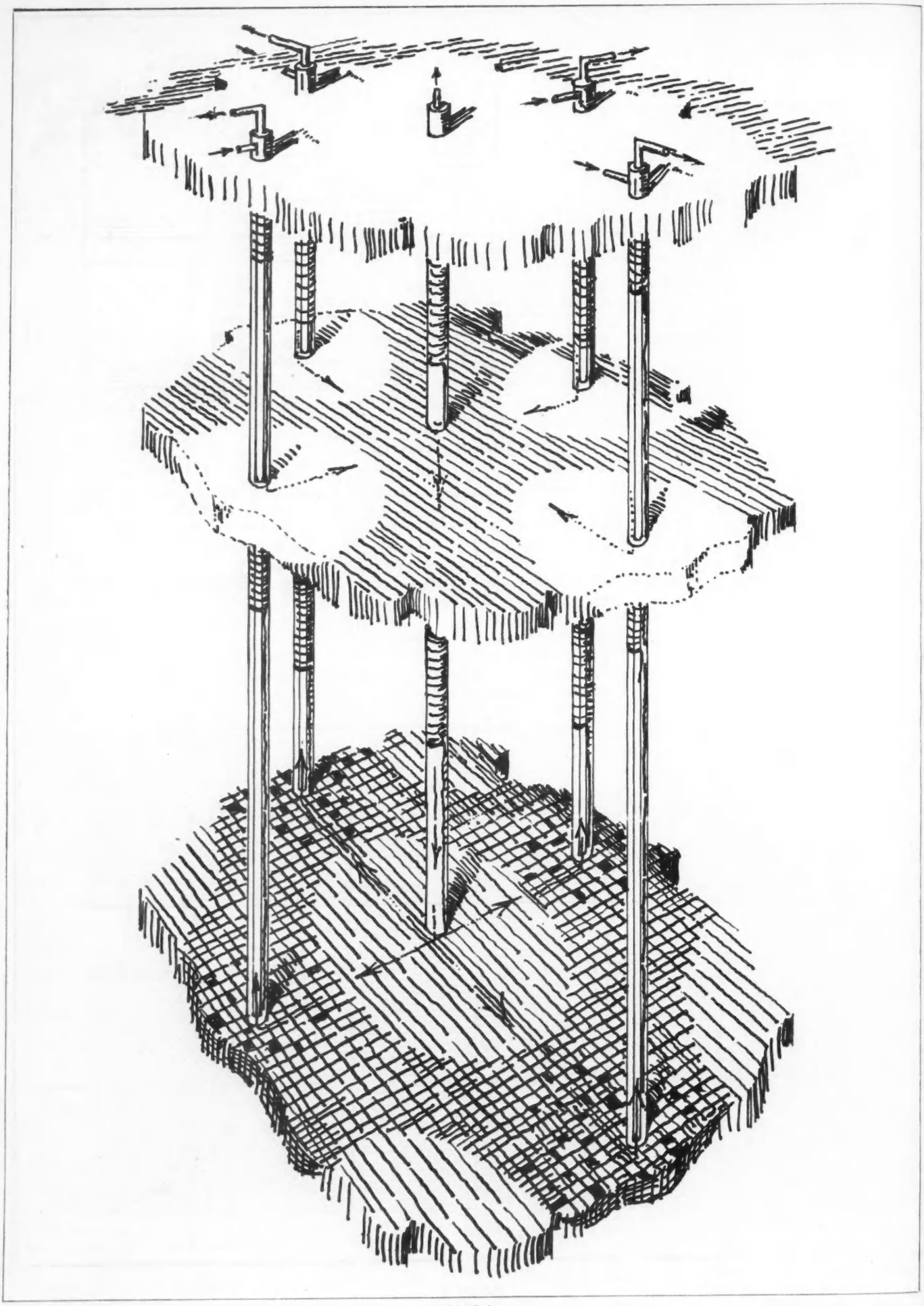

FIGURE 2

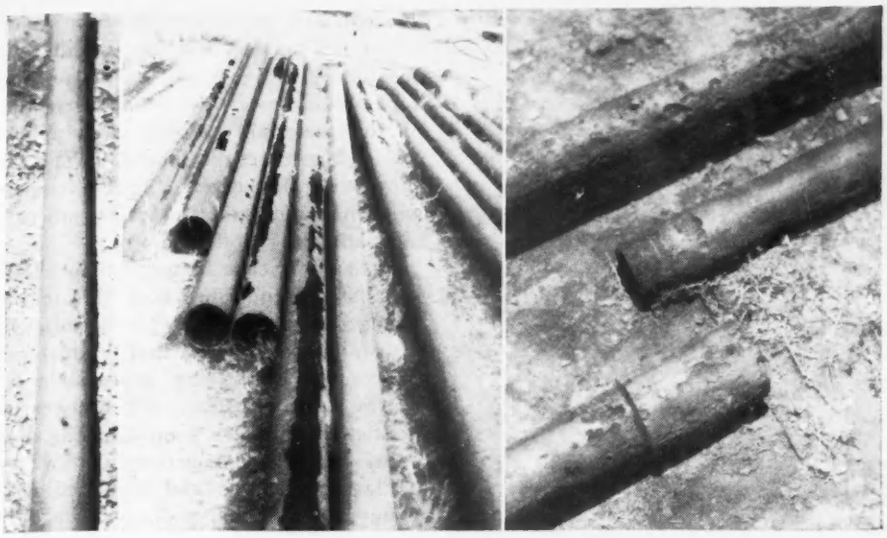

FIGURE 1—(Left). A joint of tubing on which the line of corrosion pits is clearly indicative of the electrical origin of the trouble—through stray currents which escaped at points where damage was caused.

FIGURE 2—(Center). Electrolytic corrosion on a string of casing, in which the concentration of damage is evidence that the stray currents in the well lines were the basic cause.

FIGURE 3—(Right). Corrosion resulting from combined effect of hydrogen-sulfide contaminated brine and stray currents.

Insulation of Pipe Fittings with *Plastics*

By J. A. CLAY, JR.
Service Engineers, Inc.
Fort Worth

THE AUTHOR discusses stray currents in production lines and the potential damage they can cause. The remedy for stray currents is their elimination through thorough insulation of lines at frequent intervals by use of dielectric materials in flange or other connections. Recommendations are made as to methods to be followed in applying plastics in the field.

THE corrosion of oil field equipment constitutes a production problem in many areas, resulting in a monthly repair bill of more than $10 million. There are, or may be, many causes of oil field corrosion, but there is one source of trouble resulting from stray electric currents that is frequently overlooked because by itself it may be considered insignificant and because in many cases the resulting damage is hidden and not discovered for many years.

Stray electric currents, as used in this paper, are defined as those electric currents found in flow lines, gas gathering or injection systems, fuel lines, rod lines, polished rods and all other steel or metallic structures other than ordinary transmission lines and cables. Stray currents have been found in all of the items listed above; in fact, they have been found in almost every type of production equipment. Yet they have been disregarded by many operators because they have been thought incapable of causing appreciable damage.

Effect of Stray Currents

One ampere of direct current may remove as much as 20 pounds of iron or steel in one year. Even that would not be particularly alarming if it were certain that the metal was being removed uniformly over a large area; however, that is seldom the case. Corrosion due to stray currents alone will usually be found to be localized over a very small area. The tubing shown in Figure 1 illustrates the type of damage to be expected from stray current action. The line of pits is approximately 30 inches long by ½ inch wide by ⅛ inch deep and could have been caused by 0.10 amperes of current in only 90 days. The exact period of time and the magnitude of the current that caused the damage shown are unknown and for reasons explained later cannot be determined. Figure 2 shows the result of currents acting on 6⅝-inch casing. This picture shows part of the top 600 feet of the casing string in question which entailed a replacement and workover cost of approximately $5000. Several wells in the immediate area required similarly expensive workovers for the same reason. Note how all of the damage to the pipe is on one side and in a straight line. This is typical of electric current action.

From the foregoing it may be concluded that a stray current alone can cause appreciable damage, but it has a still greater adverse effect. Quite a few wells are primarily attacked by what might be called "chemical corrosion." Chemical corrosion is usually defined as that due to hydrogen sulfide, carbon dioxide, organic or mineral acids, alkali, etc., when the metal is attacked directly by those agents. Laboratory experiments have shown that the rate of corrosion, or chemical reaction, is greatly accelerated when an external source of current is introduced into the system. The penetration rate may be multiplied two to ten fold. For example, the chemical corrosion penetration rate in a certain well may be 0.10-inch per year, and a small stray current may also have an individual penetration rate of 0.10-inch per year. The two agents acting together may result in a penetration rate of one inch per year.

Figure 3 indicates the severity of corrosion that might be expected from the combined action of a hydrogen sulfide saturated brine and a stray current. The well from which the tubing shown was withdrawn is in an area known to be subject to chemical attack, but such severe corrosion was hardly expected from that quarter alone. The well was checked and stray currents were found to be entering it via the surface equipment. Insulation of the well from its surface equipment has since reduced the corrosion rate appreciably.

The origin of stray currents and the paths through which a circuit may be completed are debatable subjects, but the existence of such currents is supported by several thousand actual measurements in the field. These currents are usually of small magnitude, less than one ampere, and may vary according to the existing conditions at the time of measurement. It has been found that the terrain in which flow lines and other pipe lines lie play an important

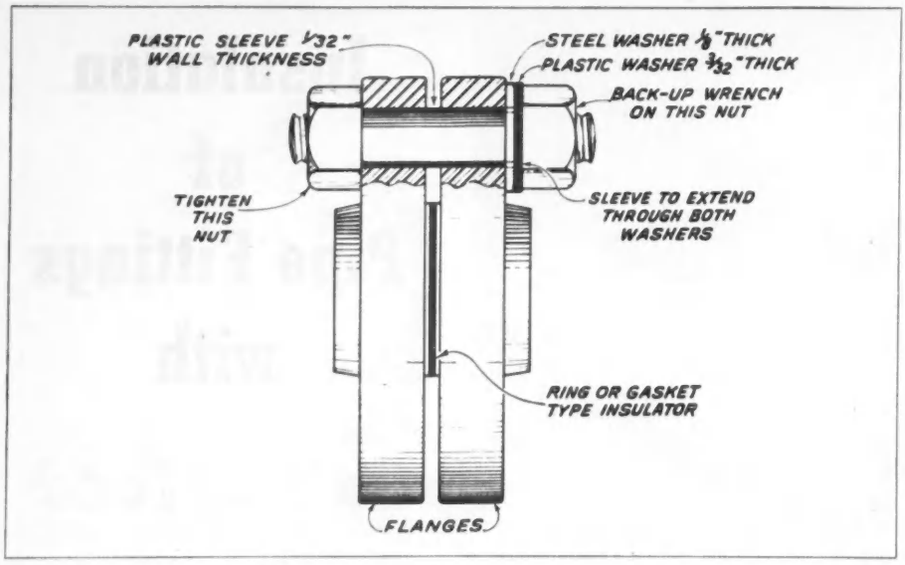
PLASTIC SLEEVE 1/32" WALL THICKNESS
STEEL WASHER 1/8" THICK
PLASTIC WASHER 3/32" THICK
BACK-UP WRENCH ON THIS NUT
TIGHTEN THIS NUT
SLEEVE TO EXTEND THROUGH BOTH WASHERS
RING OR GASKET TYPE INSULATOR
FLANGES

FIGURE 4—A typical assembly for insulating flanges, showing method of placing plastic insulators and proper point for applying force when tightening bolts of flange assembly.

part in the magnitude and duration of currents. Lines in swampy areas, or natural lows in which moisture can collect, usually show the highest currents, and the magnitude of a current in a given line will usually increase after a rain. According to the conditions present, currents may vary in magnitude from 0.01 to 12 amperes, removing from 0.2 to 240 pounds of iron per year.

Stray Currents Stopped by Insulation

How are these currents going to be stopped? By breaking all of the known circuits. A fundamental law of electricity is that a current cannot flow unless there is a complete circuit. Note the common house-light switch. When the switch is off there is no current to light the lamps, even though the potential of 110 volts still exists. Complete the circuit by throwing the switch, current flows, and the lamps burn. According to this all that must be done is to break the circuit with an electrical insulator or switch.

Laminated plastics have been used as insulators in the electrical industry for more than 30 years; therefore, such plastics should be suitable to insulate oil field equipment if their other properties are adequate. Any such material must have the following characteristics if it is to find use in the oil field:

Resistance to acids, both organic and inorganic; resistance to alkalies; resistance to hydrocarbon solvents and compounds; water resistance, low absorption rate; good mechanical strength, tension, compression and impact; capability of withstanding high gas pressures; good dielectric strength, insulator; must not be affected by weathering, sunlight, or high temperatures; must be adaptable to standard oil field equipment; must be inexpensive.

One material could hardly excel in all of the above properties, and it is therefore necessary to select one that will meet the majority of the requirements satisfactorily. A laminated, phenolic resin, fabric base plastic has proven the most satisfactory of all materials tried at the present time. For oil field insulating purposes, items such as pipe nipples, bushings, insulated couplings, gaskets, polished rod insulators and items to insulate standard API flange unions have been developed.

Mechanical Strength of Plastics

One of the main disadvantages of any plastic material is its low mechanical strength when compared to steel; however, the material used is stronger than would be suspected and a little care in installation will permit the items mentioned above to be economically used. The tensile strength of rods or whole stock is about 10,000 pounds per square inch, but there was some doubt as to the shearing strength of threaded items such as pipe nipples. Numerous tests showed that the shearing strength of the threads on a plastic pipe nipple was equal to the tensile strength of the body of the nipple at the last thread scratch. The stress concentration point at the last scratch and the fact that an absolutely straight load could not be applied did lower the tensile strength of the material per unit area appreciably. However, the figures in Table 1 show that the material in the nipples will withstand sufficient loading to permit satisfactory oil field use.

Field experience in more than 10,000 installations indicates that the tensile strength of a plastic nipple is sufficient for ordinary usage, but that the material will not withstand any appreciable eccentric or side loading. For this reason plastic pipe nipples should be installed either in rigid connections or swings.

Plastic bushings and insulated couplings have found widespread use in insulating domestic taps from main lines in city water and gas distribution systems. These items will withstand large torque or bending forces and are therefore deemed suitable for use where shock bending forces are likely to occur, i.e., a boy riding a bicycle into a gas meter.

High-Pressure Problems, Flange Insulation

A recent problem in insulation is the high-pressure gas-distillate well where operating pressures are sometimes as high as 5000 psi. The wellheads and Christmas tree fittings are of the flange union type utilizing a ring type gasket for sealing purposes. Tests on plastic ring gaskets to be used in insulating this type of fitting show that up to eight-inch pipe size such gaskets will withstand the API test pressure of twice the rated working pressure. Due to limitations in the testing equipment, 15,000 psi. is as high as these tests have been taken. Gaskets for ten and 12-inch pipe size have been tested only to 10,000 psi. for the same reason. Some sizes of these gaskets have been in actual field use under a working pressure of approximately 5200 psi. for about three years and show no signs of deterioration or failure in any manner. Plastic ring gaskets of several types and designs have been tested during the past five years,

TABLE 1

Plastic pipe nipples—Physical data

Size, In.	O.D. In.	I.D. In.	Wall Thickness, In.	Threads per Inch	Tensile* Strength Lbs.
Standard, 500 psi. working pressure					
2	2.375	1.875	0.250	11½	7,500
2½	2.875	2.250	0.313	8	10,400
3	3.500	2.875	0.313	8	12,600
4	4.500	3.750	0.375	8	19,200
High-Pressure, 1,000 psi. working pressure					
2	2.375	1.625	0.375	11½	9,600
2½	2.875	2.000	0.438	8	14,700
3	3.500	2.500	0.500	8	18,800
4	4.500	3.375	0.562	8	27,800

* Tensile strength as shown is the straight-pull load the nipple can withstand without rupture or shearing of threads, no internal pressure.

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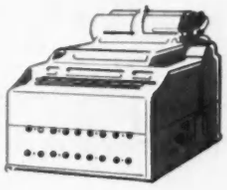

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and it has been found that the API octagonal cross-section gives the best ring. The octagonal ring may be used in either the oval or octagonal groove since all of the sealing action takes place on the 23-degree beveled surface and not on the bottom of the ring.

An insulating ring gasket alone will not insulate a flange union since current can be transmitted through the steel bolts which hold the flanges together. It is therefore necessary to insulate the bolts and nuts from each other and from the flanges. This is done by means of plastic bolt sleeves and washers. A typical insulated flange assembly is shown in Figure 4. A standard API or ASA flange is so designed that no alterations are necessary to use insulating materials. The bolt holes are one-eighth inch larger than the bolts thus permitting the use of a 1/32-inch thick bolt sleeve.

Bolt sleeves are designed to be a snug fit over an all-thread stud bolt, and to extend as far as practical through both flanges and the two washers without danger of being crushed when the flange is tightened. A recommended length is twice the flange thickness plus the raised face, plus one-eighth-inch allowance for the gasket. This length leaves a margin of safety equal to the thickness of the two washers, about 3/16-inch.

The steel washer shown in Figure 4 is used to prevent possible shearing of the plastic washer at the edge of the bolt hole. If a steel washer is not used the plastic washer may crack, and if one washer in the entire assembly cracks the insulation as a whole is no good. Both washers, metal and plastic, are designed to fit snugly around the plastic bolt sleeve, and it is imperative that the sleeve extend through both washers and butt up against the nut. To prevent tearing the plastic washer the nut adjacent to it should be held stationary as a backup. A burr on the threads inside of the nut will jam the nut and prevent the bolt from turning, thus eliminating the possibility of tearing the bolt sleeve.

Table 2 is presented to permit determination of the insulating material required for any flange. The table is self explanatory but it should be noted that a standard size washer cannot be used. The outside diameter of a standard washer is so great that the washer cannot be placed between the bolt and the hub of the flange.

There has been some speculation that current will bypass an insulated fitting either externally through the soil or internally via the fluids flowing in the pipe. To prevent external bypassing, the pipe should be either coated or raised above the ground for a distance of at least 50 pipe diameters on each side of the fitting. Flanges should be wrapped and coated to prevent bridging between the flange faces. Most wells are insulated at the Christmas tree or pumping tee under which conditions the pipe is usually above the ground for the required distance. There has been no evidence of a current bypassing an insulated fitting via the internal fluids. Should such action occur it would be shown by severe internal pitting near the fitting. The pitting would be located at the point where the current left the pipe to enter the fluid.

The efficiency of an insulated fitting can be checked by measuring the current stopped and the current passing through or around it. The current stopped by the fitting can be measured by placing an ammeter across the fitting, making a contact on each side. The current passing the fitting can be determined in two ways, the easier of which is to measure the voltage drop between two points on the pipe, preferably close to the fitting and on that side away from the current source.

About the Author

J. A. CLAY, JR., attended the University of Southern California and Texas A. and M. College, graduating with degrees in mechanical and petroleum engineering. After leaving Texas A. and M. he worked for Stanolind Oil and Gas Company in areas including Pampa, Wink, Odessa, Tulsa and Fort Worth, Texas. He was equipment engineer in the Fort Worth division office when he resigned in January, 1946, to start his own firm of Service Engineers, Inc., at Fort Worth.

The current can then be calculated from the equation

$$I = \frac{E}{R}$$

Where I = Current in Amperes.
E = Voltage drop in volts.
R = Resistance of circuit in ohms.

An average resistance of 0.00008 ohms per square inch per foot is a good figure to use for steel line pipe. The voltage measured will usually be small since the length of pipe between contacts is generally small, five to 50 feet, and one must be careful to get all of the data in the same units. For example: A voltage drop of ten millivolts (0.010 volts) between two points 40 feet apart on a two-inch flow line would give what current?

Area of pipe $= (\overline{OD}^2 - \overline{ID}^2) \times 0.7854$
$= [(2.375)^2 - (2.067)^2] \times 0.7854$
$= 1.08$ sq. in
Resistance $= 0.00008/1.08$ ohms per ft.
$= 0.0000741$ ohms per ft.
Total resistance $= 0.0000741\ (40)$ ohms.
$= 0.002964$ ohms.
Current $= 0.010/0.002964$ amperes.
$= 3.37$ amperes.

The other method is to bridge the fitting with a short copper wire, break the line behind the fitting and measure the current with an ammeter.

The point to be emphasized in taking these measurements is that good electrical contacts must be made. A recommended procedure is to wire-brush the contact spots, wipe dry with a rag, file a bright spot or notch and use jack points on the ends of the leads.

Summary

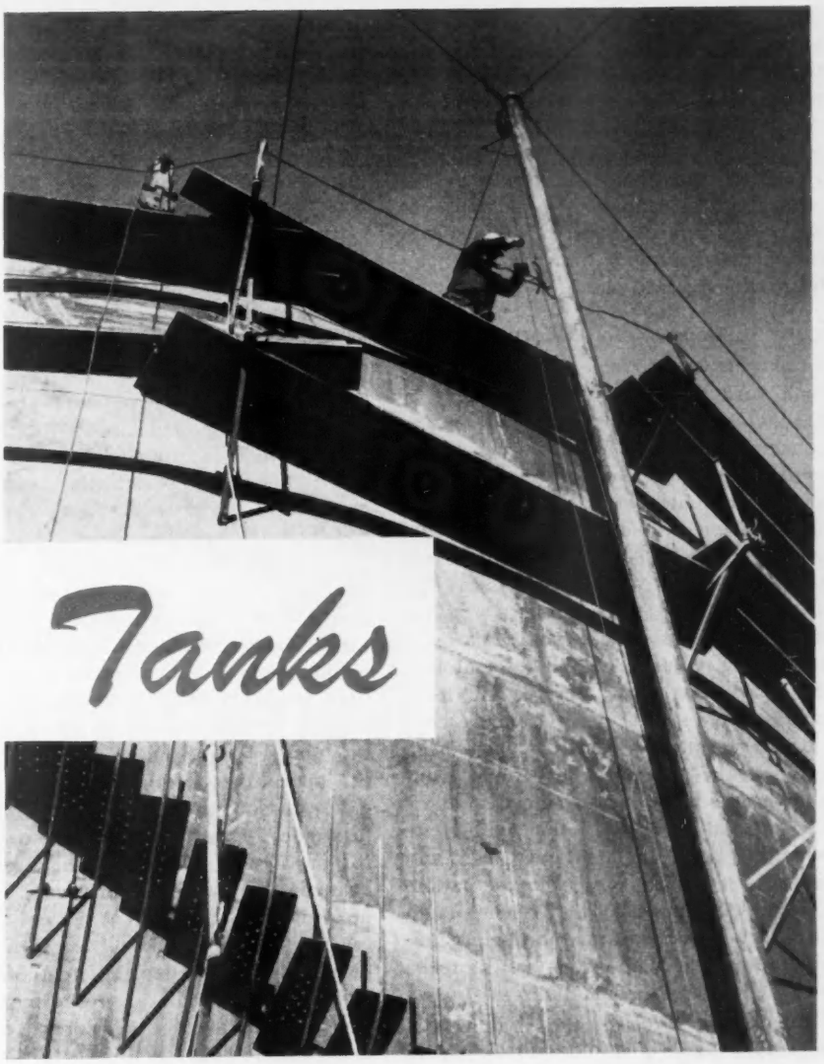
The fact that an electric current will cause corrosion of steel and iron, accelerate chemical corrosion, and is generated by chemical action has been definitely proven for many years. It has also been proven that the breaking of the electric circuits in piping and well systems will stop corrosion directly attributable to external sources of current, and will greatly reduce chemical corrosive action.

Corrosion damage is often hidden and unsuspected until complete failure of equipment occurs, thus causing expensive repair and replacement jobs.

TABLE 2
Material list—Per flange union

Item	No. Required	Description
Bolt sleeves, plastic	Same as number of bolts	I.D. = bolt size, wall thickness $\frac{1}{32}$-in. Length = 2 x (flange thickness + raised face) + $\frac{1}{8}$-in.
Washers, plastic.....	Same as number of bolts	I.D. = Bolt size + $\frac{1}{16}$-in. $\frac{1}{32}$-in. thick. O.D. = Approx. 2 x bolt diameter.
Washers, steel.....	Same as number of bolts.	Same as plastic washers, $\frac{1}{8}$-in. thick.
Flange gaskets, flat..	One per flange union.....	I.D. = I.D. of pipe used. O.D. = O.D. of raised face. $\frac{1}{32}$-in. thick.
Flange gasket, ring..	One per flange union.....	Designate by R. number of groove.

Selection and Maintenance of Tanks In Sulfide Areas



By H. D. MURRAY
District Petroleum Engineer,
The Texas Company, Midland, Texas

THE AUTHOR discusses briefly principal factors to be considered in choice of tankage for sulfide areas, recently developed methods of obtaining improved results, the importance of a properly designed maintenance program, and compares advantages and disadvantages of types of tankage available. This paper, less the introductory paragraphs, is substantially as presented before the Spring Meeting, Southwestern District, API Division of Production, at Galveston, March, 1949.

WHEN selecting lease tanks or other storage equipment for use in the Permian Basin area, there are more problems to consider than exist in possibly any other one area. Practically all the production from that area contains hydrogen sulfide. A large percentage is accompanied by salt or sulfur water production, both of which are contributory to extreme corrosion conditions. Much of this water contains scale-forming elements, which add to the difficulties of operation of treating equipment, and in some instances, even the clean oil storage equipment. Therefore, it is necessary for a producer in the Permian Basin area to give thorough consideration to the selection of his lease production tanks and associated equipment, if he is to expect the maximum in efficient operation.

Prime Factors

Consider, then, the factors that should be considered in the selection of tanks or treaters for lease operation.

Production rates: It is desirable to have installed on any lease or for any group of wells sufficient tankage to allow efficient operation, and at the same time be able to coordinate the production rate with the rate at which the connected pipe line is able to accept the oil produced. Therefore, in deciding upon the number of units of storage that will be installed in the permanent installation, one should consider the probabilities of changes in proration and changes in productivity of the units involved. If a treater installation is anticipated, the size of this treater depends directly upon the production rate and the characteristics of the fluid produced.

Water production: In practically every producing area it becomes necessary to handle, through the lease transportation and storage system, some water at some time during the life of the producing unit. As water has no particular value, it is practical that it be separated from

the crude at the earliest opportunity to prevent overtaxing of the storage and transportation facilities. The volume of water production must be considered in deciding upon the type and size of lease treating and storage equipment. Provisions must be made for the proper separation of unexpected volumes of water and consideration must be given to increased number of wells that may be producing into the installation.

Conservation Efforts

Conservation: Conservation of the lighter hydrocarbons that are contained in production has long been a matter for concern among the oil producers. Many improvements in lease production tanks have been made, simply to allow further conservation of the lighter ends of the produced crude. Now that greater emphasis is being placed on conservation of reserves, and since it is well known that evaporation losses amount to a staggering volume of salable material, this particular characteristic of lease tank storage should be given more consideration than perhaps it has been given in the past. All the various available vessels have been designed to allow the installation of additional equipment, which, if properly maintained, can, and will, assist in this type of conservation. The tankage and treating system should be selected with conservation being considered as one of the main results to be obtained from the installation.

Corrosion resistance: Since the effects of corrosion have a decided emphasis in the selection of the tankage, the kind of material of which this tankage is to be constructed must be considered. Does it have all the features desirable for a corrosion preventive program? Is the material thick enough for a reasonable life expectancy? Are protective coatings necessary at the time of installation? Will usage prevent application of protective coating at a later date? Can outside appearances be maintained to desired standards? All these questions must be considered and answered, or compromises reached, before the final selection of the necessary tankage is made.

Salvage value: Salvage value should be considered, if it is expected that equipment will outlast the life of the lease. Can the unit be effectively used in some other location at minimum expense, or will it have no value until it is reprocessed? Will it be possible to reclaim full value, or will the vessel be useless because of its construction or the nature of the material of which it is fabricated? There is not a stock answer for these questions, and each operator must decide for himself after having considered all the other factors.

Operators' standards or policies: Quite often, in selecting the necessary storage equipment for a new lease or replacement equipment, it is necessary to consider standards or policies that have been set up by management. It is often worthwhile or necessary, in order to maintain the desired standards, to eliminate some minor, yet valuable, new feature when making your selection. Each operator or each area's supervisor should be free to decide upon the merits of changes when these changes conflict with accepted standards.

Changes in design: As has been mentioned earlier, improvements are continuously being made in all production equipment. It is often necessary to consider these improvements, such as changes in design or changes in material used, and whether these changes can be incorporated into the system without affecting any of the previously mentioned factors, yet at the same time give more desirable results as the installation is operated. These changes may have been made to eliminate undesirable production or maintenance problems, or they may have been made to improve the appearance of the installation. For either reason, a constant search should be made by the individuals responsible for such selection for all new proven changes that can be incorporated in the new installation.

Cost per unit: Quite often, if it were permissible to forget the item of cost, it would be possible to secure more desirable installations, but normally it is necessary to balance this factor against all of the other factors. Actually, one usually has this factor in mind as he is considering the other factors. It is not possible, in every case, to obtain all the features that may be most desirable at a satisfactory economic figure. Compromises must be made.

Material and Design Developments

Materials: Various types of metals and coatings have been used in an attempt to reduce the damage that has been caused by hydrogen sulfide and other corrosive substances produced with the crude in the Permian Basin area. Tanks constructed completely of aluminum, porcelainized steel, galvanized steel, galvanized wrought iron, and black steel covered with various types of coating materials have been used in these attempts. One predominant success, in the writer's experience, is that obtained from aluminum decks for bolted tanks. There are tanks in West Texas and New Mexico on which aluminum decks have been in service in extremely corrosive areas for more than 12 years, and these decks, when recently inspected, appeared to be in perfect condition. Their resistance to corrosion has prevented the formation of heavy metallic scale which normally forms on the under side of the steel decks. This scale, when it falls to the tank bottom, apparently contributes to an increased rate of corrosion within the tank bottom. Unprotected steel decks installed in these areas normally last from 18 to 24 months. The use of this material for such purposes was retarded for some time due to the cost, but now, with favorable price comparison, many companies are making installations of aluminum decks on their bolted steel tanks, and some have gone so far as to standardize on this type of material for decks.

Experiments in Coatings

Protective coatings: For many years it has been the practice in the Permian Basin area, when damage due to corrosion became apparent or when it was known that such damage could be expected, to apply protective coatings to the interior surface of the steel tankage or other vessels. Since no single material was available that would completely protect these surfaces for an indefinite period, many different kinds of coatings and paints have been used experimentally with degrees of success. For quite some time asphaltic or coal tar base coatings were considered to be the best obtainable materials; but in recent years the development of plastics of various types has resulted in protective coating materials being developed that promise to give more effective protection than did the former materials. Three annual inspections have been conducted in the Permian Basin area, each more extensive than the last, which have developed information on plastic materials. There does not now exist a common basis of comparison which allows a satisfactory analysis of the results that are being obtained. This matter is being considered by the West Texas Chapter and officials of the National Association of Corrosion Engineers. However, the use of protective coatings has proven desirable and economical enough that most operators make use of the materials available to varying degrees.

Galvanizing the metal surface of steel tankage has been in use for an undetermined period, and in many areas has given very satisfactory results. Galvanized wrought iron decks have life histories equal to the aluminum decks, which were described above, and no doubt there are instances where galvanized coatings will perform with complete satisfaction, but unfortunately many vessels installed and in use in the Permian Basin area have not had this type of coating applied. Therefore,

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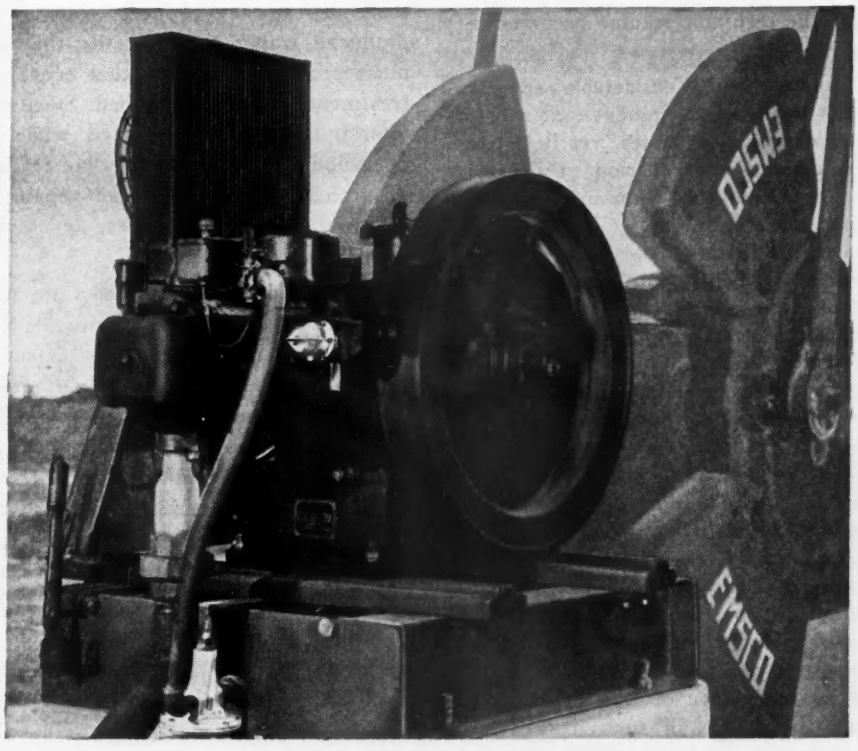

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a protective coating must be found that can be applied effectively to these units in the field.

Design: For many years cone bottom tanks have been considered as a means of alleviating the problem of tank bottom accumulations, but it was always considered an impractical thing because of the foundation difficulties. Approximately 2½ years ago, an operator in the Permian Basin area defied convention and installed what was called a cone bottom tank. This tank bottom was simply a deck inverted—the slope of the bottom being one inch per foot. The tank was set on an earthen foundation with the soil being shaped to accommodate the form of the bottom. A sump was installed at the center of the cone to allow thorough withdrawals of all accumulated waters and basic sediment. After observing the results of this installation for a short period, the operator made additional installations, and the idea, when once known to others, spread rapidly. At the present time, many operators have included the cone bottom tank into their standard installations. As was pointed out above, the cone bottom design was employed initially as a means of reducing tank bottom accumulations. However, after a reasonable period of operation, examinations revealed that corrosion difficulties on the bottom of the tank had been materially reduced also. Since protective coatings had not been applied to all of these bottoms, the only other explanation is that the corrosion rate apparently was reduced by being able to draw off the corrosive fluids at regular intervals, thereby eliminating the formation of concentrated solutions.

Beneficial Change

This change in design is considered most beneficial because of the results that are obtained and because the cost of such bottom in comparison to the unit cost is negligible.

Gasket materials: For operators who choose to use bolted steel tanks there has been the inherent problem of obtaining satisfactory seam and joint gaskets. The normal rubber gasket materials usually deteriorate within three to four years and it is then necessary to rebuild the tank to install new gaskets. Until recently it has been necessary to use wicking material to caulk joints. This wicking material actually acted as such in that it conducted the oil from the interior to the exterior and created an unsightly condition on the exterior. Often it has been necessary to do additional painting that would not have been required had this leakage been preventable. Synthetic gasket materials have reduced materially the necessity for replacement. Also it has been possible to manufacture lap joint gaskets that provide a satisfactory seal at the points where it was formerly necessary to use the wicking material. Naturally, these improvements reduce the outside maintenance problem for the operator who uses bolted steel tanks. In addition, a synthetic rubber gasket and a recessed metal washer have been developed for use on the bolts—these units being installed below the nuts. This installation prevents the seepage along the bolt threads to the exterior of the tank. This again reduces the exterior maintenance problem.

Maintenance Procedure

Exterior of tanks: Lease operating personnel should give constant attention to the elimination of all leaks and seeps that appear in tank installations. Scheduled inspections by the area supervisor will strengthen such a program. The elimination of leakage will allow a desirable outside appearance to be maintained with the minimum of repair and painting. Also, a loss of valuable crude can be prevented. The volume lost from one small leak in one unit is insignificant but when this volume is multiplied by the total number of leaks that can exist in the number of units in operation, the resultant volume becomes very significant.

Conservation: Considerable sums are spent to install equipment that will prevent evaporation losses, yet it is possible, after a short period of usage, to find much of this equipment in an inoperative condition. It is useless to make installations unless they are to be used efficiently and unless the equipment is properly maintained its efficiency is greatly impaired. Huge sums of money are spent developing reserves and additional sums are spent determining methods of production that will give the greatest possible recovery from these reserves, both under primary and secondary production methods. But, unfortunately, the opportunity to add to available reserves or to present productivity is being overlooked when the equipment purchased and installed on lease tankage to reduce evaporation losses is not fully utilized. It is not within the scope of this paper to discuss the details of such losses, but it is felt that greater emphasis should be given to maintaining back-pressure valves and other equipment to the end that evaporation losses can be reduced to the minimum. Only by constant inspections and repairs is it possible to expect the most desirable results.

Constant Maintenance

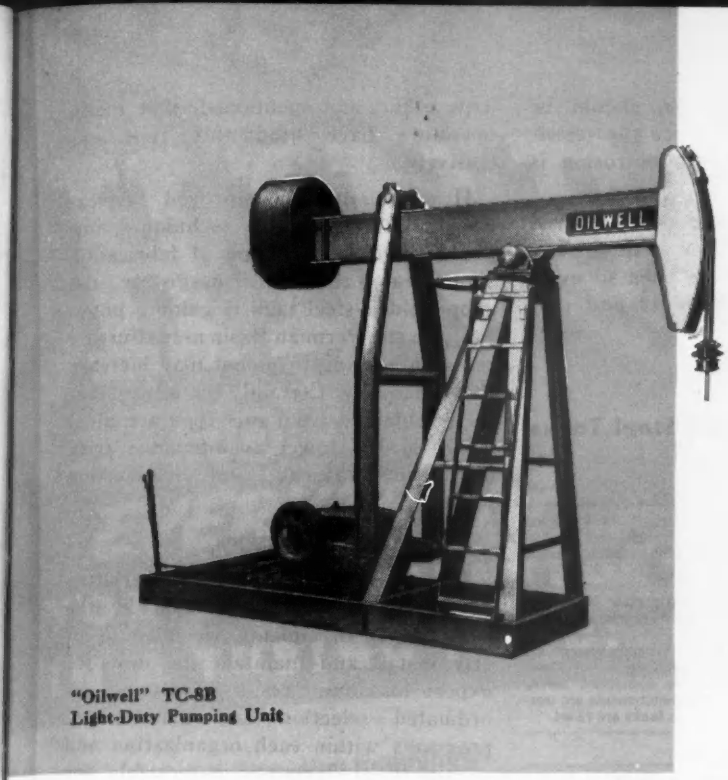
Interior maintenance: Whether the tankage be constructed of wood or steel, it is essential for the most desirable results to have in effect a constant maintenance program for the interior of these vessels. In the steel vessels particularly, unsuspected damage can be occurring and yet not be apparent until much of the body of the material has deteriorated due to corrosion and the tank is beyond economical repair. If tankage is installed in an area where it is known that corrosive conditions exist, a protective coating will probably have been applied at the time of installation. Since protective coatings have not been developed that will give indefinite service, it is still necessary that coating condition be determined and such repairs made as may be necessary, if we are to expect maximum life from our steel tankage. Also, very beneficial information on protective coating and the effects of change in design can be obtained by regular inspections, at least on key vessels or tanks. Where scale conditions are prevalent, the heating elements of treating units must be inspected and cleaned regularly, or failures will occur that will increase the maintenance cost of these units. In many instances it may be possible to eliminate scale deposits by proper treatment of produced water, but normally the volumes produced are such that economic treatments cannot be applied. Since the interior cannot be inspected while in operation, it is necessary that regular programs of inspection and repair be followed to prevent these excessive damages.

Safety: Lease storage tanks installed today have safety features provided as standard equipment, such as extended cleanout plates, pressure releases, vacuum releases, and gas vents. The pressure and vacuum releases must be maintained to protect operating personnel as well as the tankage. Vents should be kept in proper operating condition to protect personnel and prevent evaporation losses. Extended cleanout plates allow safe working conditions when it is necessary to clean, inspect, or repair the tanks.

Tankage installed before present-day safety features were made a part of a standard tank unit should have modifications whenever a feasible opportunity exists.

Stairs, ladders, walkways, and decks should be inspected regularly and existing hazards eliminated by repair or replacement of weak units or material.

In Table I an attempt has been made to compare tankage fabricated from the



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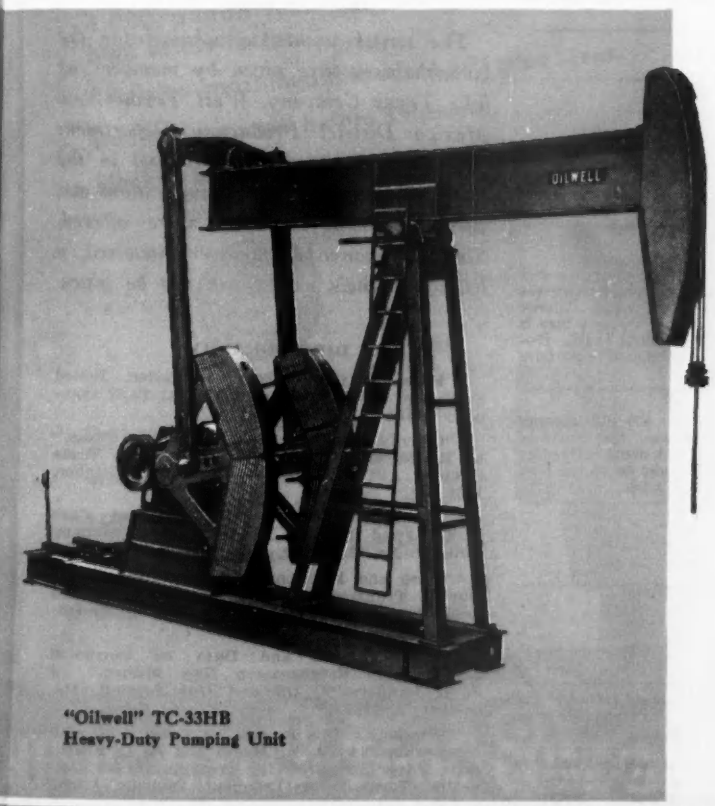
Wide range of sizes and types — The wide selection of "Oilwell" Pumping Units is made possible by the interchangeability of gear boxes and other major parts. This provides maximum economy for a great variety of pumping requirements.



"Oilwell" TC-33HB
Heavy-Duty Pumping Unit

Unit	Polished-Rod Load Capacity A.P.I. Rating pounds	Peak-Torque Capacity at 20 s.p.w. A.G.M.A. inch-pounds
Light-Duty Twin Crank		
TC-5C	5,100	24,100
TC-6	6,900	32,200
TC-8B	9,500	45,400
Medium-Duty Twin Crank		
TC-12C	10,000	60,500
TC-17C	12,800	85,600
Heavy-Duty Twin Crank		
TC-23	17,400	120,600
TC-28	17,400	145,700
TC-33HB	21,000	166,700

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various materials or by the different methods.

In this comparison the vessels constructed of wood compare very unfavorably with those fabricated from steel. It is not intended by such comparison to indicate that the use of wooden vessels should be discontinued. The problem of selection, however, should be thoroughly considered, since the resistance of wooden tanks to corrosion is not to be overlooked.

Bolted steel tankage has enjoyed great popularity for some time. The disadvantages listed have been so overshadowed by the advantages and perhaps others not mentioned, that many operators have used this type exclusively.

However, due to improved fabrication and transportation techniques, improved coatings, location of fabrication shops nearer the area of usage, etc., the shop-welded steel tank is gaining popularity in the Permian Basin area. Further research and improvement may increase this popularity. Certainly the advantages to be obtained from this type are most desirable for lower maintenance cost, decreased leakage, and evaporation losses.

TABLE 1

Comparison of Wooden, Bolted Steel, and Shop Welded Steel Tanks

Wood	Advantages	Disadvantages
Capacity		As size is increased structural weakness increases. Unit Size can be changed only by dismantling and cutting down or installing smaller units.
Conservation		Due to construction and climate almost impossible to prevent leaks and evaporation losses.
Corrosion Resistance	Wooden portion highly resistant to corrosion.	All metal fittings and parts highly susceptible.
Salvage Value		Wooden tanks must be dismantled before moving. Repair material requirements are usually expensive when wooden tanks are re-set.
Standards	Standard sizes can be secured.	
Design—Changes		Not susceptible to design change.
Unit Cost		Initial cost comparable to welded steel tanks. Special foundation requirements usually present.
Material Development		Limited range for material development.
Maintenance		Normally maintenance costs are high if an attempt is made to prevent leaks and maintain appearance.
Bolted Steel		
Capacity	Available in commonly used sizes. Unit size can be changed by adding to or removing sections from the original unit.	
Conservation	With average expense tanks can be kept vapor and liquid tight. Only low pressure can be held on bolted steel tanks.	Leaks and evaporation losses increase rapidly, unless an effective maintenance program is in force.
Corrosion Resistance	With protective coatings and/or cone bottoms, etc., corrosion rate can be reduced.	Unless protective measures are taken minimum life can be expected. Thin steel sheets will fail earlier than thick sheets in welded tanks or wooden staves.
Salvage Value	Usually higher than wooden tanks. Hardware and gaskets required for re-setting.	
Standards	Standard sizes and shapes can be had. Variations in metals and/or coating can be obtained to suit location.	
Design—Changes	Desired design changes can be made at time of major repair or re-setting.	
Unit Cost	Usually lower than tanks of other materials.	
Material Development	Development in materials can be incorporated at first major repair or re-set.	
Maintenance		Constant maintenance is required to prevent leaks of fluid and vapors from seams. Exterior and interior repairs are more frequent than is experienced in Shop Welded Steel Tanks. Protective coatings must be maintained in corrosive areas.
Shop Welded Steel		
Capacity		Usually, size limited to 500 Bbl. capacity due to transportation problem. Size cannot be reduced without cutting tank down, re-shopping and re-welding. Tanks must be moved from battery location to do such a job.
Conservation	Most adaptable since leaks and seeps will be held at a minimum. Pressures up to 1 lb. can be held on shop welded steel tanks. Very low maintenance cost to obtain desired results.	
Corrosion Resistance	Maximum life can be expected from unprotected tanks due to plate thickness. Protective coatings can be expected to increase life.	
Salvage Value	Usually higher than the other two.	
Standards	Standard sizes and shapes can be obtained. Variations in metals are not so available as they are with bolted tanks.	Metallic coating normally not applied.
Design—Changes		Only available on new or re-shaped tanks.
Unit Cost		Usually highest cost per barrel of storage.
Material Development		Only available on new or re-shaped tanks.
Maintenance	Minimum costs are incurred. Protective coatings are as applicable as to bolted steel tanks.	

Conclusions

Regardless of the type of material or the fabrication methods used in the construction of tankage, we must properly install and maintain the units to expect maximum results. Only by coordinated selection and maintenance programs within each organization and within the industry is it possible for all the various factors to be properly evaluated to obtain the most beneficial effects. Operators, manufacturers, and associated services must continue to pool all information gained by experience to insure that new and effective features and/or materials are developed and placed in use. Wherever problems are encountered a cooperative program should be initiated to gather available data towards the solution of the problems.

Acknowledgement

The writer wishes to acknowledge the valuable assistance given by members of The Texas Company, West Texas-New Mexico District Production Department and by other interested personnel in the Permian Basin area. Many suggestions and very applicable criticisms were offered. Since so many persons were involved, a listing of their names will not be given.

BIBLIOGRAPHY

[1] "Economic Comparison of Wooden, Bolted Steel, and Welded Tanks," National Tank Company Bulletin No. 19, 1932.

[2] "Gravity Conservation for East Texas," by R. W. Erwin, presented before East Texas Chapter API at Longview, Texas, in October, 1939.

[3] "Recommendations for Grades and Care of Oil Field Tanks," National Tank Company Bulletin No. 20, 1932.

[4] "Care and Maintenance of Oil Field Tanks During Transportation, Erection, and on the Lease," by Brad Mills, *The Oil Weekly*, December 27, 1937.

[5] "Field Studies and Data on Corrosion Problems in Southeastern New Mexico," by J. I. Laudermilk, *Oil and Gas Journal*, December 7, 1946.

[6] "Protecting Oil Storage Tank Bottoms with Magnesium," by J. R. James and R. L. Featherly. Paper prepared for presentation at Galveston, Texas, before Petroleum Division, AIME, October 3-4-5, 1946.

[7] "Plastic Coatings and Corrosion," by C. G. Munger, Technical Director Amercoat Division of American Pipe and Construction Company, published in July, 1948, issue of *Brush and Spray*, an Amercoat Publication.

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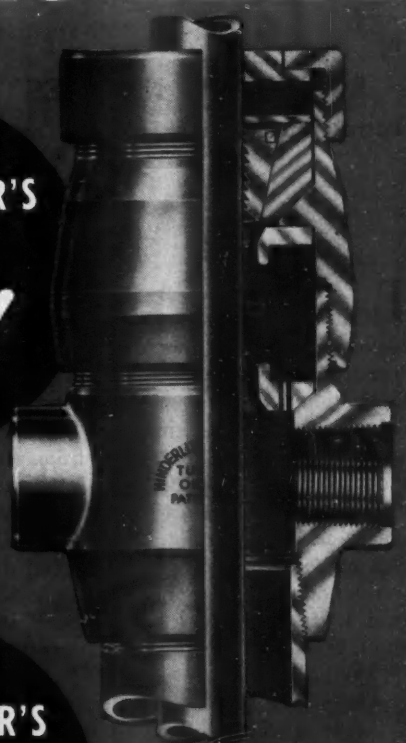

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Acidizing Techniques in Sand Formations

By EDWARD N. JONES
Petroleum Engineer, Pettus, Texas

ACIDIZING of sand pays to remove all or part of the soluble binder between the quartz grains has been developed to where it can be used to provide greatly augmented flow channels in the formation in the vicinity of the bore hole. Wells which were in the marginal or even in the non-productive class before treatment have been brought to the profit side of the ledger through this process. The author illustrates his article with charts and graphs demonstrating the methods selected and results obtained.

THE application of acids to wells producing from sand horizons has been practiced for several years although this application has not been as widespread as results seem to justify. The first such treatment for a sand formation was undertaken in the Pettus area of Texas with the idea of removing calcium carbonate scale formed in a pumping well. This experiment was successful and the production of the well was increased from 12 to 56 barrels per day and the result aroused considerable interest in the possibility of using acids to treat sand formations. This opened a new line of investigation in acidizing techniques which primarily had been confined to the treatment of lime zones. It is not intended to discuss the action of acid on limestone formations but to point out the entirely different problems to be encountered when applying acid in the treatment of wells producing from sand bodies. Acid reacts quite differently when used in lime and in sand sections.

All wells are not subject to successful acidizing, and only by a thorough knowledge of acid and acidizing techniques can the use of acids be successful. The decision of whether or not to acidize a well is not too complex if the operator is thoroughly conversant with the nature and reactions of acid. Unfortunately, acidizing procedure is not adequately covered in most engineering schools, although it behooves the engineer to be capable of understanding well conditions and to determine whether such conditions are suitable for the successful application of acid to a producing formation, whether lime or sandstone.

The data that should be considered in a recommendation before acidizing are numerous and each well should be studied individually as no two wells react the same or are completed in the same manner. Essential well information to be considered includes bottom-hole pressure, electric logs, well core data, water level, oil level, gas level, completion method, equipment installed, permeability, both vertical and horizontal, contents of sand, mud and water loss, type of well, condition of sand body, and past and present producing record. A great many wells have been ruined by the use of the wrong type of acid, the use of too much acid, miscalculation of the time element, or the wrong method being used. One not experienced in the use of acids naturally assumes the only method is to force the acid back into the sand body by pressure, gravity, or whatever method applicable just as long as the acid is put in the formation. This is definitely wrong, as acid may be applied in many different ways, methods, and treatments.

Acids are known not to dissolve the true sand grains but to destroy or open up the cementation of the formation to create a more permeable structure with larger void spaces, this in turn causing the oil to seek the lower pressured area near the well bore. The calcareous bond of the sand grains in the Gulf Coast is made up of lime 1 to 12 percent, and bentonite 20 to 30 percent, with some bentonite contents running as high as 46 to 54 percent.

Reason for Acidizing

The true reason for acidizing is not to enlarge appreciably the bore hole but to cause channels in the sand body and as near as possible to return the sand body to virgin condition before water and mud have caused the effective change in permeability and void spaces.

Modern operators and engineers are beginning to realize the true value of good low water-loss muds. The lower water-loss mud that an operator uses the more certain he is to have a good well and better cementing jobs, although with a low water-loss mud one tends to have a definite penetration of water, which is highly dangerous in a bentonite type of sand such as occurs in the Gulf Coast series.

Oil-base muds are becoming more prominent and will become more so in the future. Objections against the use of oil-base muds have centered on the price factor due to the muds having to be mixed with a diesel oil, while the sticky quality of the oil-base mud on the rig floors creates a hazard to personnel. Oil-base muds cannot be removed as easily as water-base muds.

The reason for not permitting water to enter the formation is due to the swelling effect of the water on the bentonite in the formation. It is known that most oil-producing sand horizons are not homogeneous and that they contain small shale lenses. If these lenses appear in the sand some of the shale is intermingled with the sand. Some of these impurities contained in the sand have very little or no significance as far as acidizing is concerned, while others with a highly acid soluble content are dangerous to acidize. It is important that the sands and their composition be known.

Some acid jobs to sand formations have decreased instead of increased the production. Such failures generally may be attributed to the technique involved in applying the acid or to the use of an unnecessary high volume of acid.

C. S. Ross of the U. S. Geological Survey reports: "Recent microscopic and X-ray studies on bentonite indicate that it possesses crystalline rather than

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Above: Twin Disc Hydraulic Torque Converter.

Left: A Twin Disc 11500 Series Hydraulic Torque Converter transmits the power of this Waukesha engine to the mud pump on a work-over rig owned by the Oil Production Maintenance Company of Houston, Texas. This rig drilled 47,932 feet and did five work-over jobs with trouble-free service from the Converter.

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

colloidal character, and that the material probably consists, in the main, of the definite mineral leverrierite. The pseudo-colloidal behavior of the clay in aqueous suspensions is regarded as due to the micaceous (laminated) structure of the fine mineral particles, which are, however, for the most part of greater than colloidal dimensions. The flake form of the particles would give them relatively enormous surface, and the penetration of water between the flakes is assumed to account for the tremendous swelling power of the clay when water is added to it."

Cores from wells are often thrown off the rig floor after the sections for analyses have been obtained. In many cases these same cores, if examined a few days later, seem to be cracking apart or small cracks appear in the cores. The water penetration due to drilling during time of coring makes the bentonite swell which causes the separation of the formation in these cores. This condition occurs in a formation that contain bentonite and the phenomenon occurring in a sand body will tend to decrease the permeability as well as the void spaces causing the formation to close, thereby restricting the oil or gas into the bore hole.

Acids used in wells include the following component parts:

1. Inhibitors, used to protect the metal from acids. One type of inhibitor is used in wells to a certain bottom-hole temperature; another is used in wells of a high bottom-hole temperature.

2. Hydrochloric acid, a carrying medium used principally to dissolve limes and to maintain a low pH to the live as well as to the spent acids.

3. Detergents, used in degreasing the material dissolved.

4. Surface active chemicals, used to lower the interfacial tension, thereby causing the removal of any water block.

5. Emulsion breakers, to destroy or minimize emulsions resulting from the mixture of chemicals and their dissolved products with the formation fluids present.

6. Wetting agents, used to facilitate penetration of treating mixture into material to be removed.

7. Hydrofluoric acid, to dissolve mud cakes, bentonites, and other clay-like materials.

The operator, when ordering acid for well treatment, generally receives one-half hydrochloric acid wash and one-half mud acid composed of hydrofluoric acid. Each of these types of acids is important. They are to be used together in most all cases. The quantity of acid to be used will, of course, depend strictly on the well conditions and information known, also the type of job to be done. The type of acid to be used should be determined by men familiar with the type of sand and whether the sand cementation is composed of ash, bentonite or limes, as determined by various sand tests. Each of these principal materials tends to increase the possibility of a successful job if the correct treatment is given and the correct type of acid used.

Generally, the entire charge of mud acid is pumped into the sand and followed by acid wash. Often it is better to split the acids, or first pump in acid wash, then mud acids, then acid wash and so on until the entire quantity of acid is pumped into the well.

The hydrofluoric or mud acids will dissolve three times as much material as the acid wash. It would be simple to assume that the acid wash, having the lower dissolvability of the two, will stay alive a greater length of time and will destroy the small amount of limes, letting the mud acid destroy the bentonites, which is the higher content of the formation. Also the mud acid will tend to neutralize more quickly. The acid wash injected ahead of the mud acid will regenerate the mud acid, thereby bringing back to the surface a live and active acid and all materials dissolved.

Time Element

The time element is another important factor. The time of pumping acids into the formation depends on the pressure. After acid has been pumped into the formation, proceedings should be started to get the acid back out of the formation as soon as possible.

Too large a quantity of acid is generally used for a first treatment, as the amount recommended is usually based on the footage of perforations in the hole. Acid ,when breaking down the formation, will not break it down over the entire area, but within a restricted area, generally the most permeable. For instance, if an operator has 50 feet of perforations, the Bradenhead squeeze with a combination of soaking, pressuring, and displacing will clean the entire sand face giving all the sand body an equal chance to produce its portion of the gas or fluids. This can be effectively worked on most wells if the correct rig operation is performed. (An acid treatment is a very inexpensive method of working over and even though several jobs have to be done the cost is still cheap.)

The time of leaving the acid in the formation averages from three to 24 hours. The acids should be removed as soon as possible and brought back still alive rather than in a neutralized state. This is one major danger as the acids will dissolve a part of the formation, and if the acids are not of sufficient strength, the dissolved formation will filter out in the sand body; thereby causing the sand void spaces to become clogged. This has happened on more than one occasion.

As an example, one operator used a 1000-gallon treatment on a low bottom-hole pressure well, the sand having a high bentonite content, intending to leave the acid in the formation three to six hours. After the treatment and a few hours of waiting only a small amount of the acid was recovered. In order to alleviate the damage already done, 100 gallons of acid was used and this treatment succeeded in removing a part of the first 1000 gallons used but the effort and expense were wasted as the formation was plugged and did not have sufficient bottom-hole pressure to channel around the bridged void spaces.

Pumping wells often can be worked

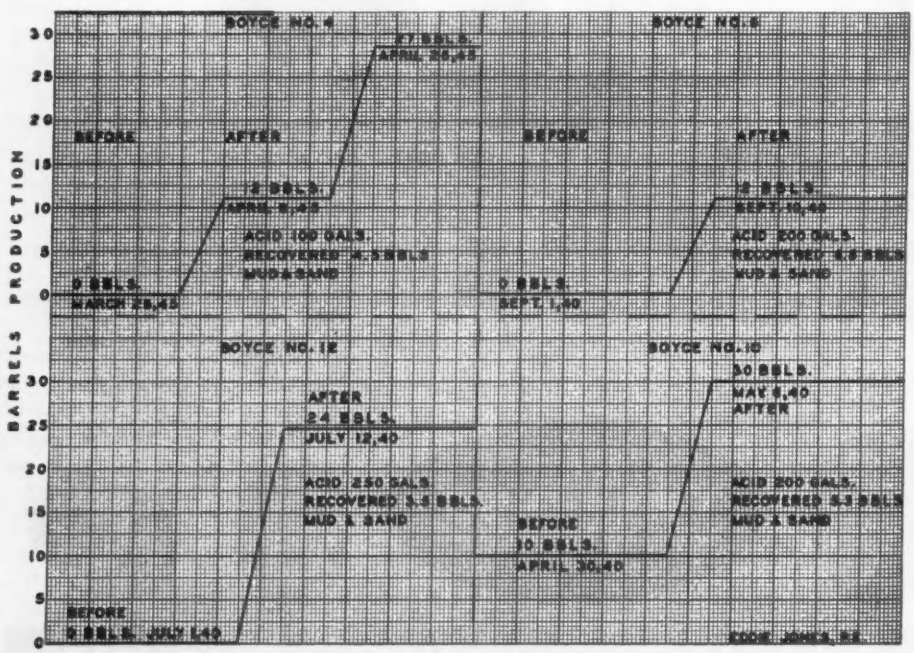

FIGURE 1. Burnell field, Pettus sand.

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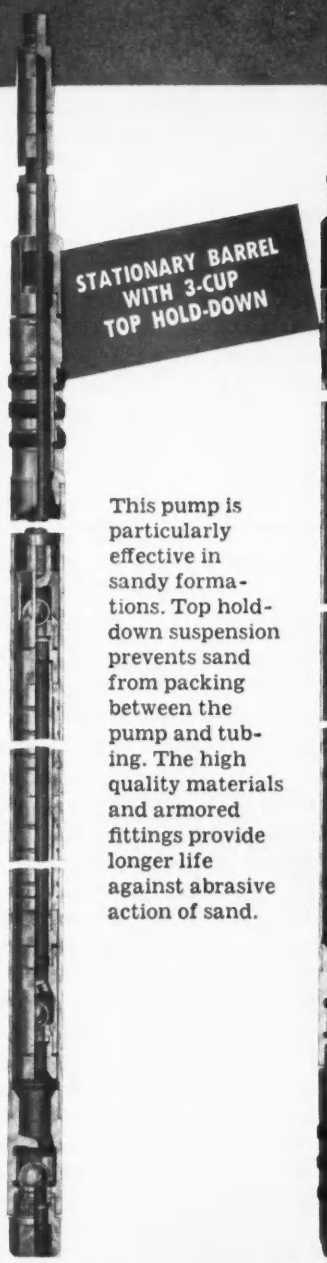
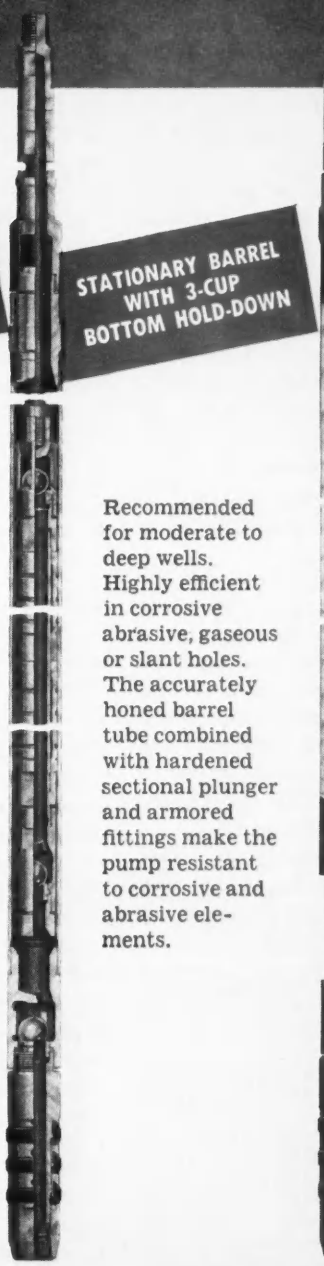
D+B Challenger Pumps are unsurpassed for economical and efficient well production under a wide range of conditions. The barrel tubes are made of high grade seamless steel tubing, precision honed to a mirror-like finish. The grooved sectional plungers are made of hardened cast iron for maximum strength and durability. High quality materials, improved design and precision workmanship make D+B Challenger Pumps outstanding for low-cost, high-volume production under severe operating conditions.



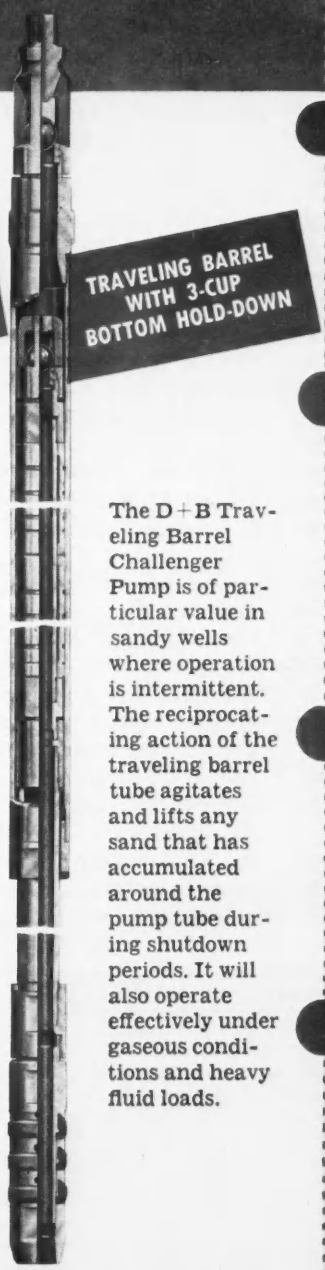
STATIONARY BARREL WITH 3-CUP TOP HOLD-DOWN

This pump is particularly effective in sandy formations. Top hold-down suspension prevents sand from packing between the pump and tubing. The high quality materials and armored fittings provide longer life against abrasive action of sand.



STATIONARY BARREL WITH 3-CUP BOTTOM HOLD-DOWN

Recommended for moderate to deep wells. Highly efficient in corrosive abrasive, gaseous or slant holes. The accurately honed barrel tube combined with hardened sectional plunger and armored fittings make the pump resistant to corrosive and abrasive elements.



TRAVELING BARREL WITH 3-CUP BOTTOM HOLD-DOWN

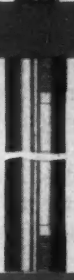
The D+B Traveling Barrel Challenger Pump is of particular value in sandy wells where operation is intermittent. The reciprocating action of the traveling barrel tube agitates and lifts any sand that has accumulated around the pump tube during shutdown periods. It will also operate effectively under gaseous conditions and heavy fluid loads.

For additional information on D+B Challenger Pumps ask for Bulletin 631-A.

H-C-I GROOVED PLUNGER

All Challenger Pumps are equipped with hardened cast iron grooved sectional pin-end plungers. Two to seven plunger sections are assembled on the precision ground plunger tube. They are made of fine grain alloy, centrifugally cast iron and heat treated for maximum life. H-C-I plunger sections are economical to replace after long, severe service.

HONED BARREL TUBE



D+B Barrel Tubes are made of high quality seamless steel tubing honed to a smooth, precision surface. This assures efficient plunger operation. The dimensions of all tubes are carefully controlled to assure complete interchangeability.

3-CUP HOLD-DOWN

The 3-cup Hold down consists of a body, 3 seating cups, 2 rings and an adapter or cup nut. Under column fluid pressure the cups expand against the precision surface of the seating shoe or nipple to assure a perfect seal. The lips of the cups are protected against turning or tearing by overhanging metal lips on the seating cup rings.

SIMPLEX LOCK HOLD-DOWN

All Challenger Pumps may be equipped with Simplex top or bottom lock or A.P.I. Bottom Lock Hold-downs as optional equipment. Shoe assemblies for use with Simplex locks are interchangeable between top and bottom hold-downs by merely changing lock seat in the shoe.

BALLS AND SEATS

Superloy Balls and Seats are standard in all Challenger Pump assemblies. They are made of a high grade stainless steel and are carefully tested for efficient valve action. Simplex Balls and Seats, made of same high quality materials are available as optional equipment.

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DEEP WELL PUMPS AND SUCKER RODS

over economically with mud acid without the necessity of pulling liners, underreaming, etc. If the well is producing water, the quantity of water may be increased, along with the oil, but the percentage of water likely will not increase because the entire sand is cleaned. Many pumping wells can handle an increase in fluids, and the increase of oil will more than offset any costs of handling additional small amounts of water.

In a pumping well there is no danger of a blowout. The rods and standing valve should be removed a day previous to putting in acid. This is to permit the well to reach its static fluid level, which should be measured at the time. The acid is pumped into the tubing, followed by sufficient oil to displace the fluids at the bottom of the hole with the acid. The tubing then can be removed and installation made for swabbing and sand-pumping operations.

The swab run on the end of the sand line does not need to have the same outside diameter as the inside diameter of the liner or the casing, but needs to be large enough so that in working up and down it will create a surging motion opposite the perforations. This is for the purpose of forcing the acid to work in and out of the perforations or liner slots, thereby drawing into the well any muds or sands which may have collected outside the casing or liner. In handling the acid in this manner it will not be forced to any great extent back into the formation yet the liner will be cleaned of any deposits of mud, fine sand, or calcium carbonate which have collected against the screen.

After working the swab up and down for some time near the perforations, a sand pump should be run to collect whatever material has been brought into the well. This process should be continued until the well is thoroughly cleaned out and all of the acid has been removed. After the well has been cleaned pumping equipment can be installed, being careful no chromium-plated steel is in the assembly, as mud acid will destroy chrome-plated metal. The well can be pumped for several days, and if it goes off, the pump immediately, should be replaced so as to continue producing the well to remove all of the acids as soon as possible. In event there is a small amount of sand coming in and the well is a light producer, a small stream of salt water or oil can be injected into the casing. This will tend to carry the sand to the top and the well will not pump down and allow the sand to settle around the bottom hole equipment. If the well being treated is not sand pumped sufficiently, a very heavy emulsion may be left in the hole which the pump cannot handle and may cause a bridging in the perforations or liner slots which will have to be removed by additional acid treatments.

One caution that should be emphasized is to remove from the hole all of the acids and the material which the acids have dissolved. Some acidizing jobs have failed and production declined because this factor was neglected.

Figure 1 illustrates four case histories in connection with acidizing of pumping wells.

A typical Bradenhead squeeze can be used on wells of many types without the removal of any surface or sub-surface equipment. The method can best be illustrated by the history of a certain Wilcox well in a South Texas pool which had quit producing. The well was loaded with water and the acid placed opposite the formation. The casing valve was opened after the acid had been on the formation for five minutes. A surface pump pressure of 1000 pounds per square inch was applied against the tubing string with the casing valve closed. It took approximately three-fourths barrel of fluid to raise the pressure to 1000 pounds per square inch. This pressure was left on the well for five minutes and then the casing valve was reopened, bleeding the well down to zero pounds per square inch. The second time, a pump pressure of 1000 pounds per square inch was placed against the formation. It took 1½ barrels to build up this pressure. The casing was bled off as before. The third time, a pump pressure of 1500 pounds per square inch was used, taking a volume of 2½ barrels to bring up the pressure. The casing was bled off again. The fourth time, 1600 pounds per square inch surface pressure was reached, taking 3½ barrels to raise the pressure. The formation broke down and pumping was stopped immediately. The casing again was bled down to zero pressure. Three and one-half barrels of acid were pumped back into the formation and the top pressure was approximately 1200 pounds per square inch. The well was brought in and now is making approximately 94 barrels on one-eighth inch choke, with no water.

These pressures, of course, do not apply to all wells as some wells will break down at much lower pressures.

In the Mineral area of Bee County, Texas, is a gas-injection well completed in the Wilcox horizon, Slick sand. The completion cost amounted to $117,000. The well had an open-flow potential of 1½ million cubic feet of gas per day, a static surface pressure of 2400 pounds and a bottom-hole pressure of 2900 pounds per square inch. The well produced a small amount of distillate and water. Completion was very difficult in that many unforeseen conditions occurred due to salt water horizons and squeezing off of water. It was squeezed and re-completed more than 12 times. During the last squeeze job a surface pressure of 7200 pounds per square inch was used with a mud column of 9.6 pounds per gallon. As this well was at 7400 feet, the operators had approximately 11,000 pounds per square inch of mud pressure against the formation. They were unable to squeeze on the last operation and had to accept the completion as it was. It was finished with 16 feet of perforated interval having 124 shot holes.

The well was in a good structural position to serve as a gas-input well in the recycling unit of the field. It was blown down before trying to inject gas and approximately three days were required for it to build up to its maximum surface pressure. The line pressure of 3200 pounds per square inch was used in trying to inject gas into the forma-

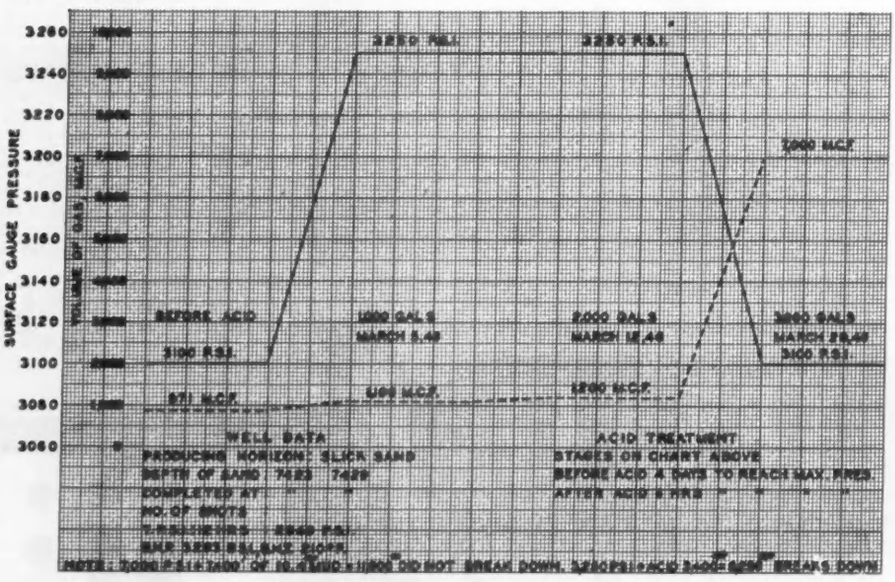

FIGURE 2. Mineral unit injection well.

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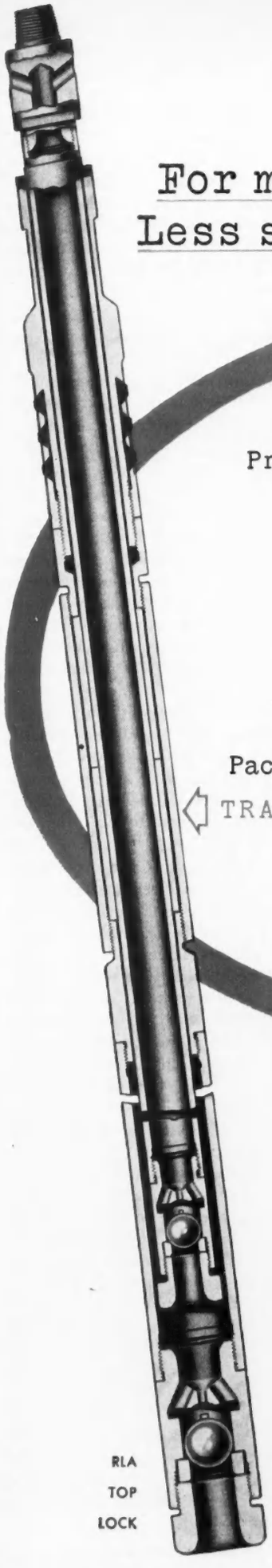

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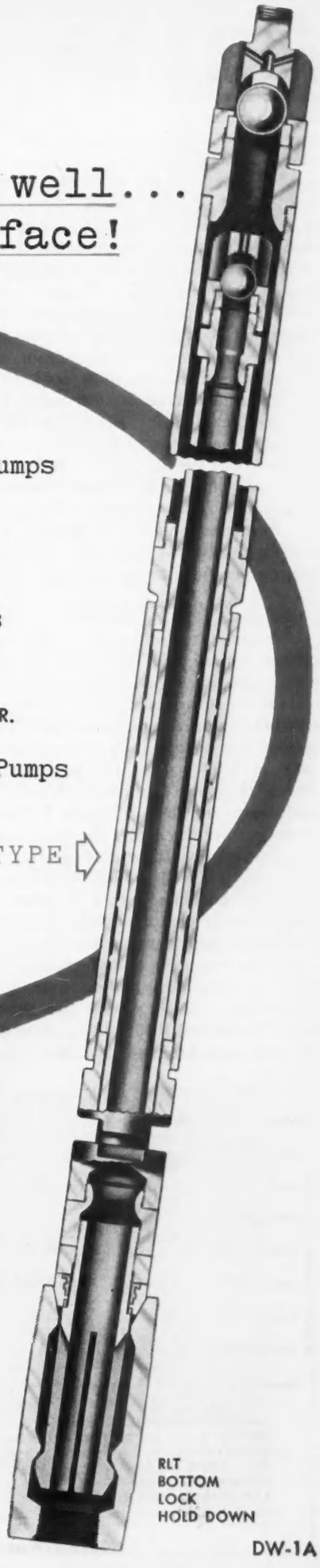

RLA
TOP
LOCK

RLT
BOTTOM
LOCK
HOLD DOWN

DW-1A

tion, but the well would not take gas. The operators did not want to spend the $76,000 which would be required to drill and complete a second well in addition to abandoning a well which had already cost $117,000. Mud acid was used to get the well to take gas. Acid was pumped into the well by the use of a typical Bradenhead squeeze. The pump pressure to start the acid was 3500 pounds per square inch. Approximately 1000 gallons of acid were pumped into the sand, with a drop in pressure to 2400 pounds per square inch at the end of the treatment. The water and acid were removed from the well by blowing, and gas again put against the formation. The well, after this treatment, took 700,000 cubic feet per day. Theoretically, the acid was supposed to have removed approximately six inches of the silicates from the well bore back into the formation. However, it appeared to have channeled back into the formation and the treatment was somewhat disappointing although slightly beneficial to gas injection.

Re-treating Process

The operators decided to re-treat with 2000 gallons of acid. The first 1000 gallons went in at a pressure of 2400 pounds per square inch. With the second 1000 gallons, pressure built up to 3600 pounds per square inch, then dropped back to 2700 pounds per square inch during pumping operations. After this acid treatment the well took 1,250,000 cubic feet per day under the same pressure as before. It was interesting to find that the well would build up its maximum pressure within a period of four hours as compared with the three days previously mentioned.

A third treatment of 3000 gallons was used. The first 2000 gallons went in at approximately 2700 pounds per square inch. The second 1000 gallons raised the pressure to approximately 3700 pounds per square inch, and while injecting the last 200 gallons, the well broke down to 2700 pounds per square inch and the pump was stopped. The pressure dropped down to 1500 pounds per square inch within five minutes after treatment was stopped. The water and acids were removed as before. The well would now take 9 million cubic feet of gas per day at a pressure of 3050 pounds per square inch.

This case history (Figure 2) is a good illustration of the stage type of treatment, showing the value of not judging what the acids will do by just one treatment, but a succession of treatments with larger amounts at each injection.

The small expenditure of money in the above work was negligible in comparison with the amount saved through not drilling another injection well. The acid treatment of this very tight well drilled close to a fault, the formation of which had a permeability of approximately 5 millidarcys, is illustrative of what can be done to at least some wells completed in Wilcox sand horizons.

Another gas injection well in the Slick sand, Wilcox series, had a most unusual treatment of 5000 gallons of acid, this being the largest single treatment known to the author.

On April 26, 1946, this well was having gas injected at the rate of 19,000 Mcf per day at 3200 pounds per square inch. The well was given an acid treatment of 2000 gallons on May 8, 1946. This treatment did not help. During December, 1946, the well was taking gas at the rate of 20,000 Mcf at 3250 pounds per square inch. During May, 1947, the well had decreased to 17,500 Mcf at 3250 pounds per square inch, which gas injection rate was not sufficient. The well was released to the air on a one-half-inch choke for a period of time; this did not help. A 5000-gallon acid treatment was suggested and was applied on May 20, 1947. This treatment lowered the well injection pressure to 3200 pounds per square inch, taking gas at the rate of 19,600 Mcf in a week's time. The well pressure was gradually increased ten pounds at a time up to 3250 pounds, when it would take gas at the rate of 23,000 Mcf per day, a substantial increase. Since this well has been treated it has continued to take the injected gas more freely. At the present time the well has had 9,288,586 Mcf gas injected into the sand section (Figure 3).

At the other extreme, a well was treated with only 500 gallons of acid. This treatment reduced the injection pressure from 4200 pounds per square inch to 3450 pounds per square inch at the same injection rate.

A pumping well in a Miocene sand section had earlier been a very good producer but had declined to five barrels of oil per day. Operators were about to abandon the well when a mud acid treatment was recommended. The tubing was pulled and an acid-soluble scale of approximately one-fourth-inch was noted on the perforations and mud anchor, although the perforations were not stopped up. The well was acidized with 500 gallons, cleaned up and returned to production. The amount of oil the well would produce after acidizing was 120 barrels per day, gradually declining to 70 barrels per day over an eight-month period. More than 50,000 barrels of oil were recovered thereafter and the well is still producing.

In this same Gulf Coast area many wells have been acidized to remove the iron sulfide corrosion from the screens and perforations in the wells. The production increases range from 100 percent to 500 percent. Almost every well acidized has been increased in production and in no case was the percentage of water increased if the correct treatment was applied. A Gulf Coast salt water disposal well had approximately 100 feet of perforations in a section of very shaley, barren sand. Originally, salt water was pumped into this well at a pressure of 50 pounds per square inch. The surface pressure gradually increased until a pump pressure of 700 pounds per square inch had to be used, causing the operators to spend considerable money in equipment changes. The well was taking at only one-half the rate necessary to dispose of the salt water being produced from other wells. This well was treated with 2000 gallons of low surface-tension acid, a 15 percent hydrochloric acid mixture with other chemicals. After acid treatment, the injection pressure was reduced to 50 pounds per square inch and the well took twice as much water as at the time of the initial operations.

(To Be Concluded)

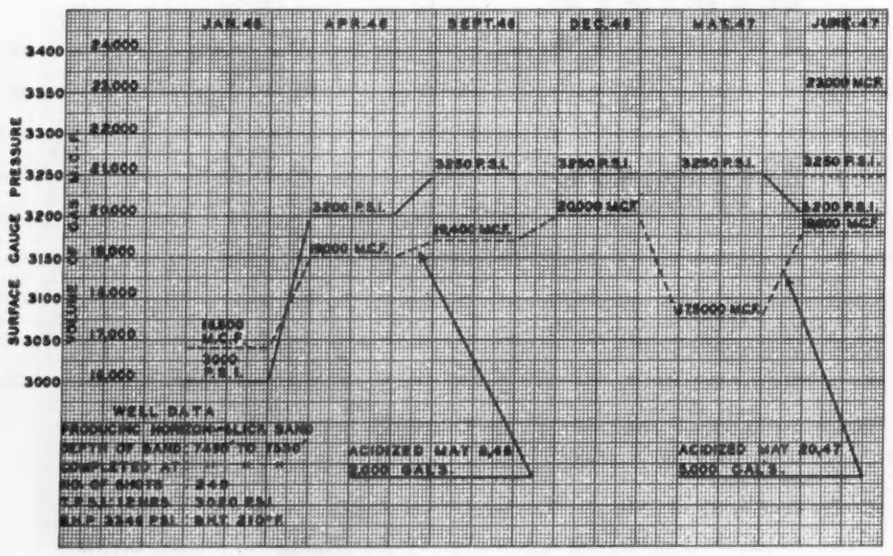

FIGURE 3. West Tuleta unit, injection well.

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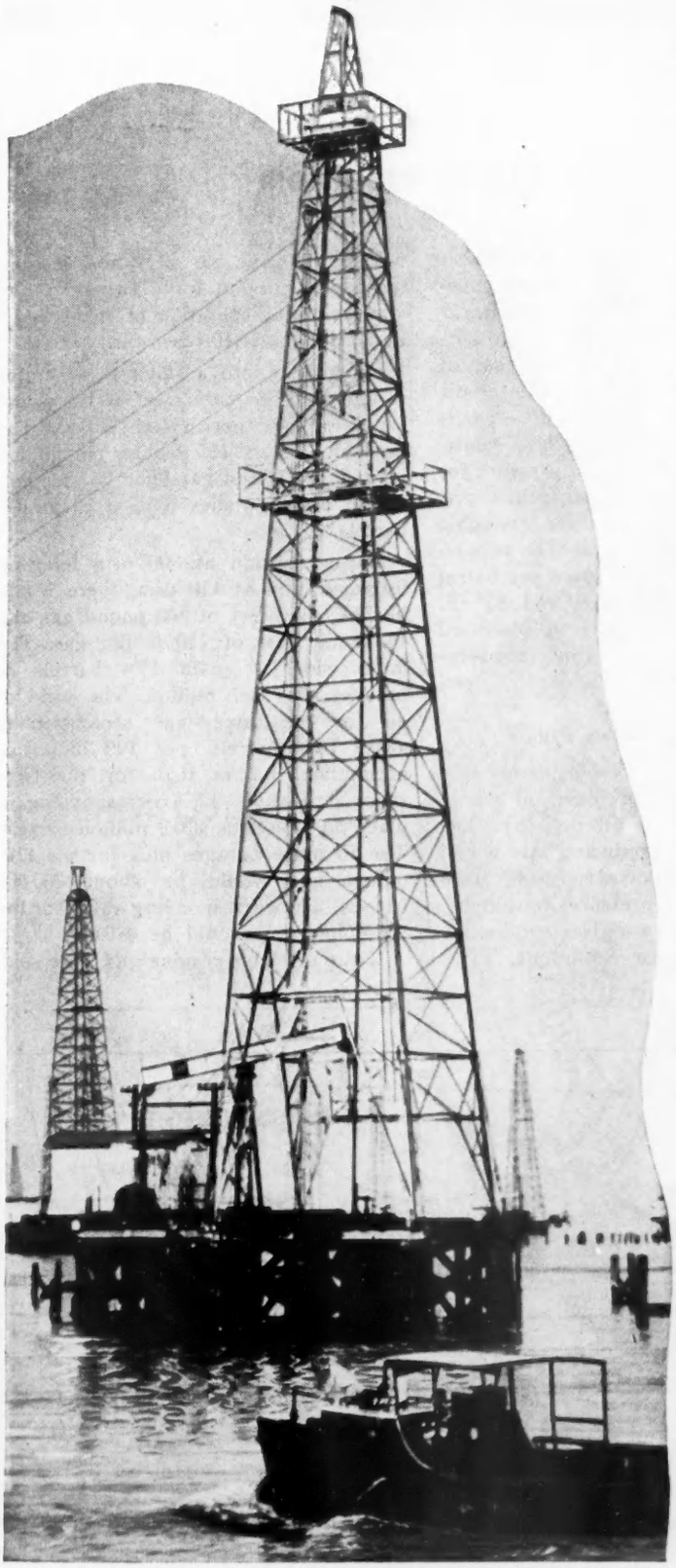

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Part 6

A RADIAL RESERVOIR

THE lowest structural contour along which wells can be completed as satisfactory producers defines the optimum location for a row of wells. When pay thickness is ample, a reservoir may have two optimum rows of producing wells. Relative to such locations, oil recovery at the time gas appears in production and ultimate recovery are maximized. Total gas requirements and therefore operating expenses are minimized. Reservoirs in which injected gas forms a large enough secondary gas cap do not require gas injection after breakthrough. The procedure already considered in the preceding articles are here applied to producing a radial reservoir by pressure maintenance with gas.

A radial reservoir having edge water is represented by Figures 6-1 and 6-2. The first figure shows structural contours on top of pay. Productive area is limited on the north side by an E-W fault. The fault is approximately vertical. The other sides of the reservoir are bounded by water. The contours are relative to the elevation of the water contact. Subtract contour elevation from depth to water contact and obtain depth to top of pay.

The closure is about 200 feet. The structure is called the R-10 reservoir. The assumed structural symmetry is for illustrative purposes only.

Figure 6-2 is a section through the center of the R-10 reservoir. The absence of impermeable breaks within the reservoir is for illustrative purposes only. There is no primary gas cap.

TABLE 6-1
Basic Data for the R-10 Reservoir

Productive acres	3600
Average pay thickness, feet	32.5
Acre-feet of pay	117,000
Radial distance to water contact, feet	10,000
Average porosity, percent	23
Average interstitial water, percent	26
Reservoir space, bbls./acre-foot	1320
Initial reservoir pressure, psia	4800
Reservoir temperature, °F	220
Saturation pressure, psia	4800
Solution gas, cubic feet/bbl. oil	904*
Volume factor, bbls./bbl.	1.41
In place oil, bbls./acre-foot	936
In place oil, million bbls.	109.5
Solution gas, billion feet	98.99*

* Separator: 100 psia. and 80° F.

The basic data for the R-10 reservoir are itemized in Table 6-1. The productive area is 3600 acres. The pay thickness averages 32.5 feet. There are 117,000 acre-feet of pay. An acre-foot of pay contains 1320 barrels of reservoir space. The initial reservoir pressure is 4800 pounds per square inch absolute, which is also the saturation pressure for oil at the 220 degrees Fahrenheit reservoir temperature. There are 904 cubic feet of gas per barrel of oil. The volume factor is 1.41 barrels of space per barrel of oil relative to 100 psia and 80° F. separator conditions. The in place oil is 109,500,000 barrels. The in place solution gas is about 99 billion cubic feet.

Gas and Butanes Plus

A five percent per year depletion rate relative to initially in place oil would be 15,000 barrels of oil per day. The corresponding gas producing rate would be 13.56 million per day aside from declining reservoir pressure. A split between oil and gas for a given production varies with separator conditions. Table 6-2 shows some gas-oil ratios and butanes plus content for a two-stage and a three-stage separation of the production from the R-10 reservoir.

Production into a 100 psia separator would yield 885 cubic feet of 100 pound separator gas per barrel of oil. The butanes plus are 15.7 barrels per million feet of 100 pound gas. The corresponding in place butanes plus are 1,500,000 barrels.

For separation at 800 psia followed by separation at 110 psia, there would be 714 cubic feet of 800 pound gas and 142 cubic feet of 110 pound gas. The latter would contain 19.4 barrels of butanes plus per million. The yield of oil for the three-stage separation is about 0.21 barrels, per 100 moles of production, higher than for the two-stage separation. The corresponding in place oil would be 110.3 million barrels. The in place butanes plus for the 110-pound gas would be about 300,000 barrels. The corresponding value for the 800-pound gas would be 480,000.

If the available residue gas were sold,

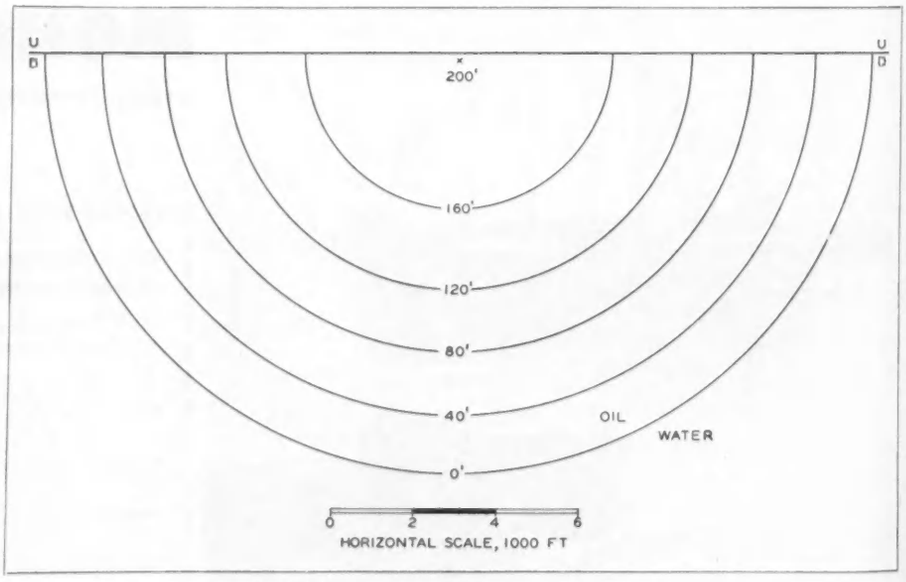

FIGURE 6-1. Contours on top of the R-10 reservoir.

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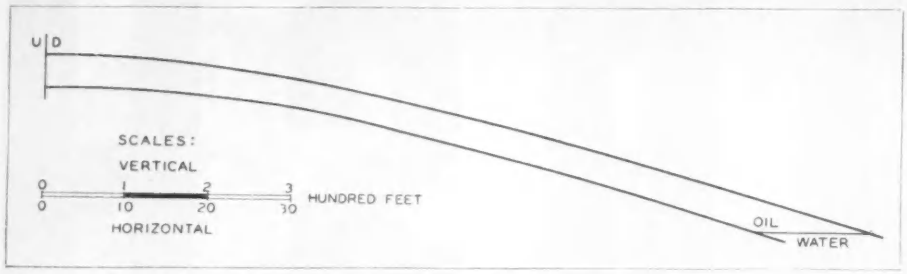


FIGURE 6-2. Section through the center of the R-10 reservoir.

reservoir pressure could be maintained by injecting water. Producing wells would be located on the crest of the R-10 structure and injection wells along the water contact. For pressure maintenance with water, the economic balance would be between injection wellhead pressure and number of water injection wells. For the producing wells, the balance would be between the cost of compressor services and number of producing wells in order to estimate the optimum producing wellhead pressure. The combined balances would fix the optimum rate of depletion. With a compressor paid for by residue gas, the probability is that extraction of natural gasoline, and possibly some liquefied petroleum gas, would be profitable.

On the other hand, if there be no market for residue gas, injection of residue after fuel and extraction could not maintain reservoir pressure. About 1.25 thousand cubic feet of makeup gas per barrel of produced oil would have to be injected also in order to maintain pressure in the R-10 reservoir. We assume that the required makeup is available from another reservoir, and will locate producing and injection wells for pressure maintenance by gas.

Invaded Acre-Feet

Figure 6-3 shows the distance from the center of the R-10 reservoir to the intersection of a horizontal plane with the top and bottom of pay. The distance to water is 10,000 feet along the top of pay and 8600 feet along the bottom of pay. Figures 6-1 and 3 define the acre-feet of pay above any elevation in the R-10 reservoir.

Figure 6-4 shows the acre-feet of pay invaded by a horizontal gas-oil interface for various distances along the top of pay. In place oil per acre-foot times the displacement factor times the invaded acre-feet gives oil recovery by injected gas.

Location of Wells

The water contact along the bottom of pay is at 8600 feet. Producing wells are located at 8300 feet and bottomed ten feet above the water level. The gas injection wells are located on the crest of the R-10 structure.

Figure 6-5 is a sectional view of well locations and the estimated position of the M contour at the time of breakthrough. Convergence for the M section when its B contour is at 8300 feet is between 0.93 and 0.94, Figure 6-6. As gas does not breakthrough simultaneously into the wells, the M contour was located at 7300 feet, that is, 1000 feet updip in order to compensate for unequal breakthrough.

Figure 6-7 is a plan view of a pressure maintenance program for the R-10 reservoir. Producing wells are on the 50-foot contour. The M contour is on the 78-foot level at breakthrough. Injection wells are on the crest. The indicated number of wells is for illustrative purposes only.

TABLE 6-2
Butanes Plus and Gas-Oil Ratio

Separator: 100 psia. and 80° F.	
100-lb. separator gas, cu. ft./bbl.	885
Butanes plus, bbls./million 100-lb. gas	15.7
Tank vapor, cu. ft./bbl.	19.0
Butanes plus, bbls./million tank vapor	78.1
Gas-oil ration, cu. ft./bbl.	904
Bbls. oil/100 moles of production	26.48
Volume factor, bbls./bbl.	1.41
Primary Separator, 800 psia.: Secondary Separator, 110 psia.	
800-lb. separator gas, cu. ft./bbl.	714
Butanes plus, bbls./million 800-lb. gas	6.14
110-lb. separator gas, cu. ft./bbl.	142
Butanes plus, bbls./million 110-lb. gas	19.4
Tank vapor, cu. ft./bbl.	28
Butanes plus, bbls./million tank vapor	102.8
Gas-oil ratio, cu. ft./bbl.	884
Bbls. oil/100 moles of production	26.69
Volume factor, bbls./bbl.	1.40

At breakthrough, about 76,000 acre-feet are invaded by gas. There are 56,000 acre-feet above the M contour. The difference or 20,000 acre-feet is the volume of the B-M region.

Let the ratio of reservoir liquid to injected gas viscosities be 36. Then the recovery from the M region is not likely to be greater than 64 percent of in place oil or 600 barrels per acre-foot. Oil recovery from the B-M region is about 39 per cent or 365 barrels per acre-foot.

The estimated breakthrough recovery is 33.6 million barrels from the M region and 7.3 million from the B-M region. Total estimated breakthrough recovery is 40,900,000 barrels.

The required makeup gas for maintaining pressure to breakthrough at 1.25 MCF per barrel of oil is about 51.1 billion feet. The total injected gas is about 81.8 billion feet of which 30.7 billion is residue from solution gas. The investment and operating expense for injecting gas against 4800 psia reservoir pressure is a huge item in the

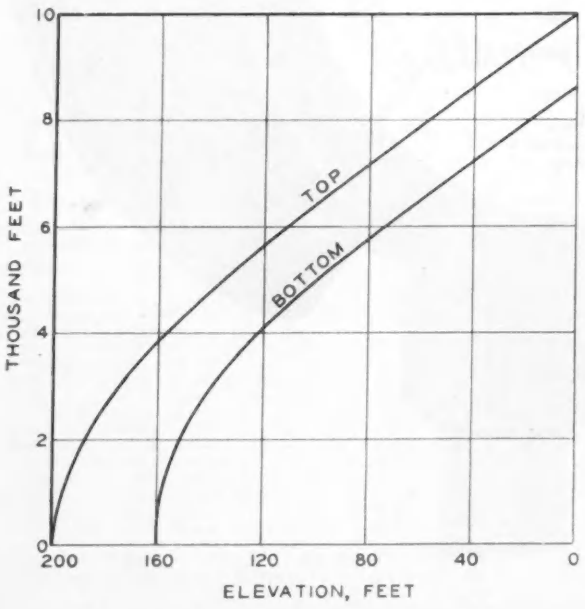


FIGURE 6-3 (Left). Distance from the center along top and bottom of pay vs. elevation in the R-10 reservoir.

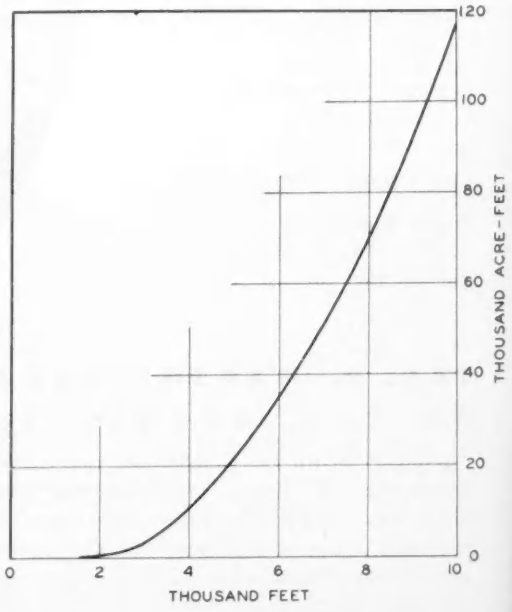
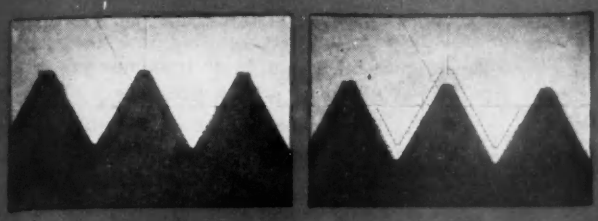


FIGURE 6-4 (Right). Invaded acre-feet vs. distance advanced along top of pay by a horizontal gas-oil interface in the R-10 reservoir.



Figures 1 and 2. The above O-C-T precision thread was moved the exact distance of five threads. Note in Figure 2 how the thread exactly matches the lower form line, indicating both perfect lead and taper.

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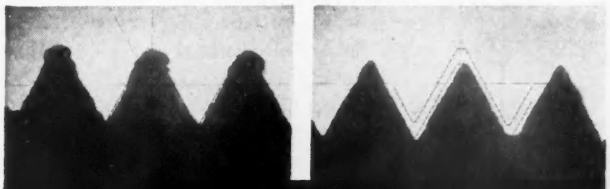
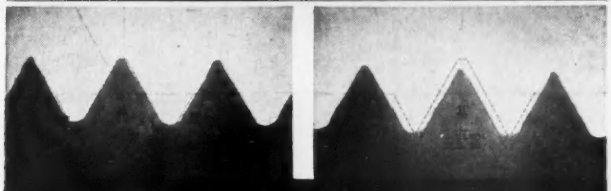
The comparator checks the lead and taper of threads by fitting a thread in the upper form line, then moving over the *exact* required distance for five threads, after which the thread should exactly fit the lower form line. Figures 1 and 2 show how the O-C-T precision thread lives up to this requirement. Figures 3, 4, 5 and 6 show examples of how stock nipples obtained from supply stores failed to meet the critical eye of the comparator.



Figures 3 and 4. This is a very rough and torn thread, cut by dull equipment. Note Figure 4 carefully. The thread went past the form line, indicating too fast a lead.



Figures 5 and 6. The thread is extremely shallow, cut by bad or worn equipment. The taper is slow, as indicated by the thread in view 6 being above the form line. The lead is slow because the thread failed to reach the form line.

Figure 7. This shows the results of screwing a thread of imperfect lead into a thread of proper lead. The result is contact on only one side of the thread and resultant leak space shown by white area.

Figure 8. The result of screwing a shallow bottom thread into a perfect thread. The shallow bottom prevents contact on the tapered side of the thread, resulting in the leak space shown by white area.

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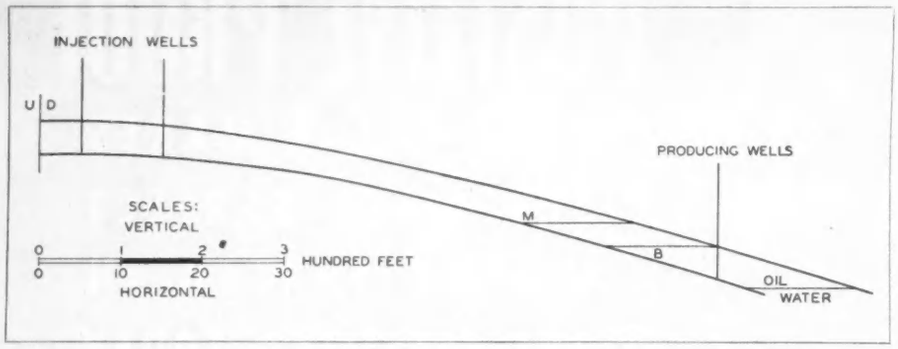

FIGURE 6-5. Section showing location of wells and the B and M levels at breakthrough of injected gas for the R-10 reservoir.

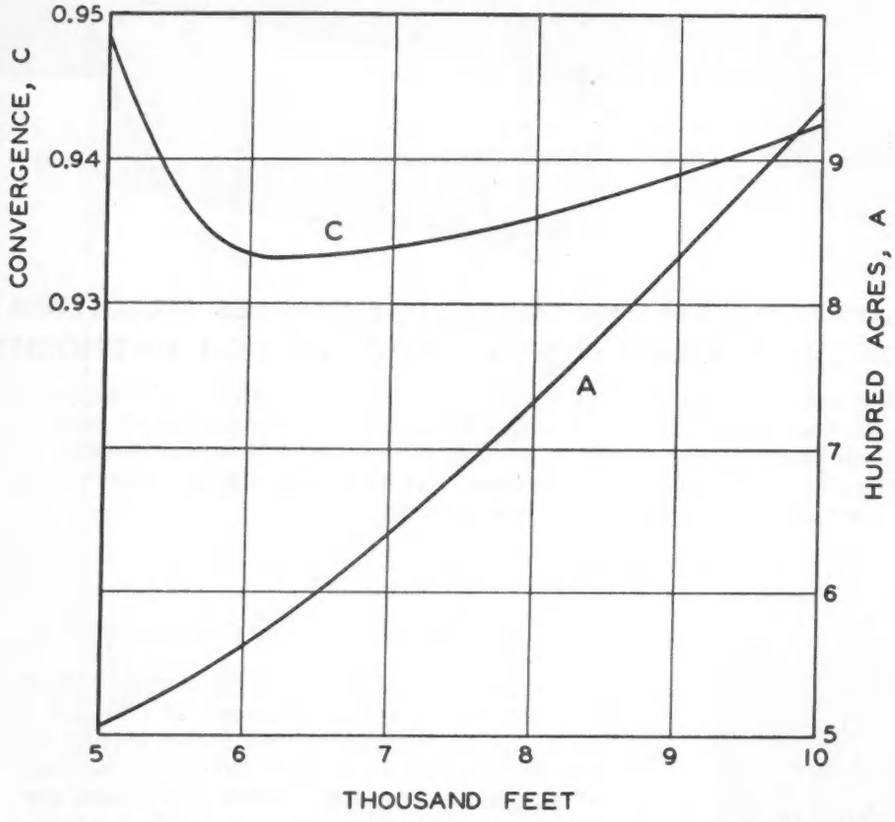

FIGURE 6-6. Horizontal area A and convergence C for displacement of oil by gas in the R-10 reservoir.

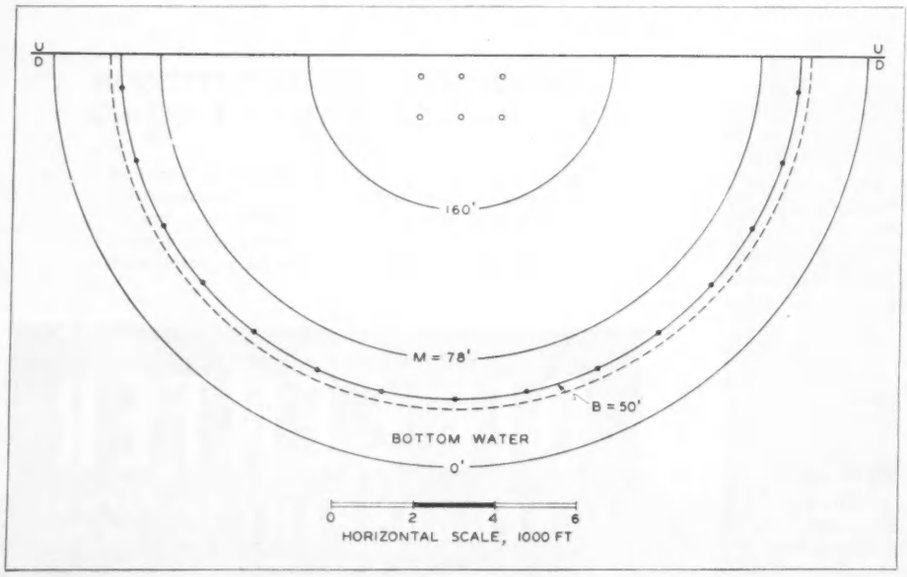

FIGURE 6-7. A program for maintaining pressure with gas in the R-10 reservoir; producing wells are bottomed ten feet above water.

present example if makeup gas is not available at a high pressure.

The oil producing rate would be 15,000 barrels per day relative to a depletion rate of 5 percent per year of initially in place oil. If the per-well producing capacity were 1000 barrels per day, 15 wells would be required.

If 2.0 MCF of injected gas were required per barrel of produced oil, the injection rate would be 30 million per day. A five million per day per well injection rate would require six injection wells.

The life of the project for a 5 percent depletion rate would be about 7.5 years at breakthrough. The 5 percent annual depletion rate is for illustrative purposes only. The optimum depletion rate may be faster or slower depending on the physical and economic circumstances attending a reservoir.

There are 90,000 acre-feet on the updip side of the R-10 producing wells. The in place oil is 84.24 million barrels. Oil recovery at breakthrough is 48.55 percent of the oil in place on the updip side.

The injection ratio is 2 MCF per barrel of produced oil. Let the economic limit be 20 MCF of injected gas per barrel of produced oil. Then the ratio at economic limit is ten. The ultimate oil recovery U at economic limit is not likely to exceed the recovery defined by

$$U = 0.64 - (0.64 - 0.4855)/10^{1/4} = 0.5531$$

or 46.6 million barrels. The estimated recovery after breakthrough is 5.7 million barrels for an injection economic limit of 20 MCF per barrel.

The probable volume of injected gas is given by

$$\frac{10(0.64 - 0.5531)}{3} - \frac{0.64 - 0.4855}{3} = 0.2382$$

times 2/0.0676 which averages about 7 MCF for each barrel of the 5.7 million barrels. Total gas injection would be 7(5.7) or 39.9 billion feet. The life at 30 million per day injection capacity would be about 3.7 years. During the 3.7 years, the production of injected gas would increase from zero to 18 MCF per barrel. Production of injected gas would average about 5 MCF per barrel of oil. Total production of injected gas would be 28.5 billion feet. Oil producing rate would decline from 15,000 to 1,500 barrels per day.

Evidently, pressure maintenance by gas injection after breakthrough is not a practical method of producing the R-10 reservoir. If gas injection be stopped at breakthrough, oil recovery by expansion plus water encroachment plus the 40.9 million by gas injection would not exceed 60 million barrels or 54.74 percent of in place oil. Any other location of producing wells would not increase the oil reserve.

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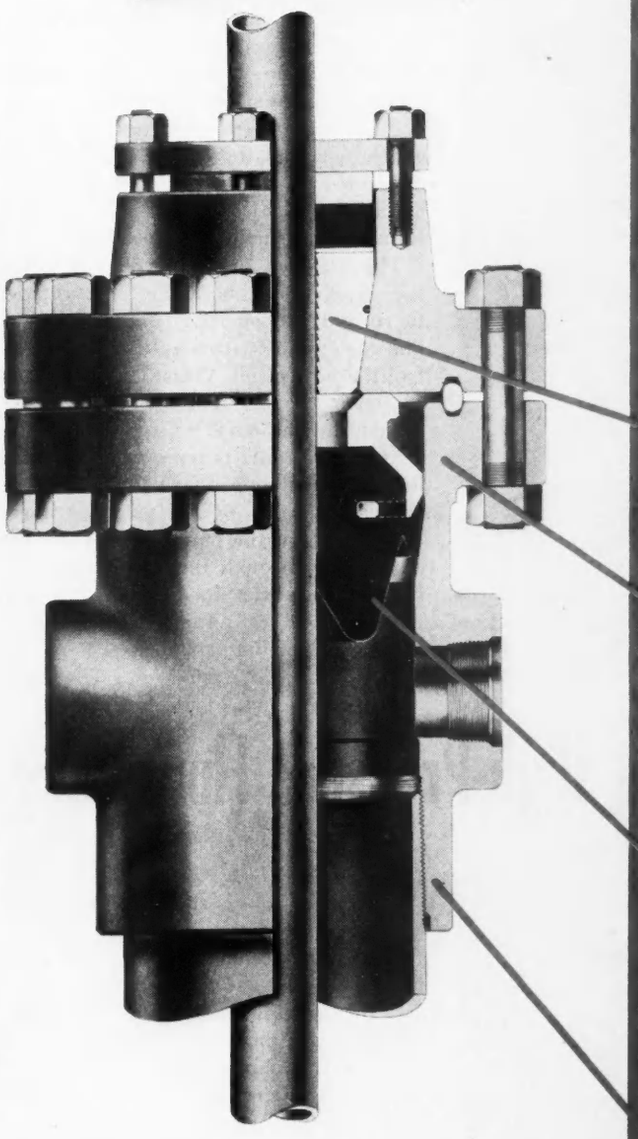

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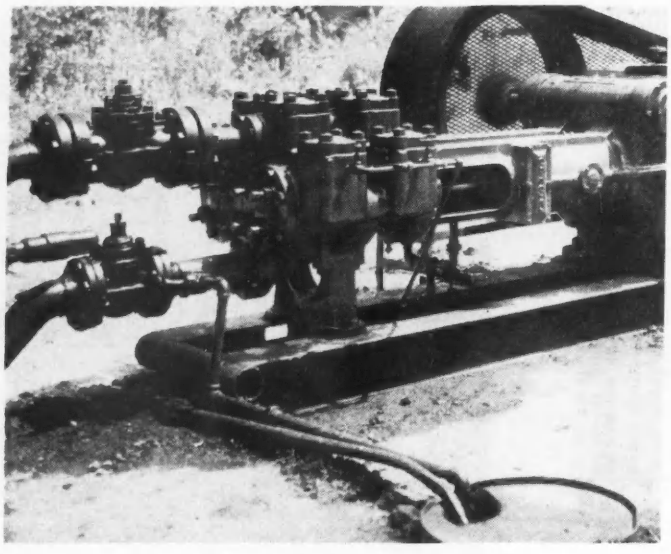
HOW TO—Drain Oil From Field Pump During Repair Work

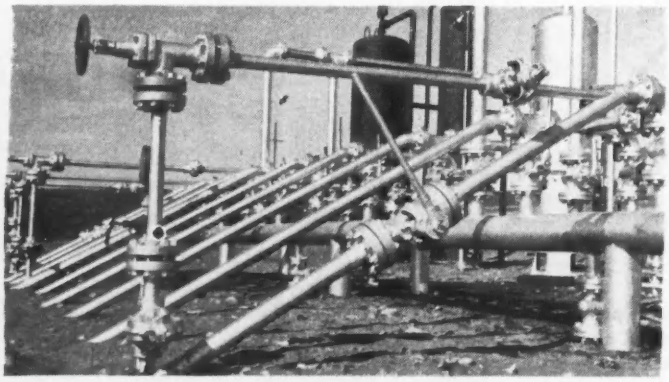


Where field crude oil pumps take suction from lease tanks and pump into high-pressure lines, it is impossible to repair the pump without spilling oil. Inasmuch as there exists a small head pressure on the suction, oil remaining in the pump cylinders and valve ports will not drain out the suction when the discharge valve is closed.

A solution to this problem is illustrated as one method by which the oil can be easily drained from the pump when it is necessary to repair valves or replace liners. Oil that remains in the pump when both intake and discharge valves are closed is drained through the suction line by a 1½-inch tap line which leads to an oil drum. This drum has been buried so that its top is at ground level. The only opening is that which accommodates the two 1½-inch lines. The second line shown is used to remove the oil which accumulates in the drum. It is connected to the suction of a smaller portable pump used to pick up oil drained from several such pump installations.

The 1½-inch drain line is welded to the short nipple between the suction valve and the pump intake. The drain line is equipped with a gate valve to control the flow of oil. When it is necessary to repair the pump, both valves are closed and the cover on one of the discharge valve pots is removed. The drain line is opened and other valve covers removed and the valves lifted. The interconnections in the pump will permit the oil to flow through the suction into the buried drum for further pickup. The pump is then ready for overhaul without spilling oil on the ground.

HOW TO—Reduce Surges in Long High-Pressure Flow Lines



Pressure surges on long flow lines carrying fluid and gas under high pressures can do considerable damage to the fluid-treating equipment. Such surges can loosen line fittings, injure regulators, and impair the proper function of separators. This situation has been reduced substantially by the use of two chokes in the flow line instead of only one.

The well head is equipped with one choke, which is used to control fluid flow. Production of several leases is brought into a central separator station where the fluids are handled. In the illustration, some of the wells caused little surging and therefore were not equipped with dual chokes. The installation shown was the method of controlling line surges on those wells which did cause some trouble.

Flow lines approach the separators at an angle to minimize stresses in pipe fittings. The second choke was installed in the flow line so that a right triangle was formed. The choke could be blocked off by valves on either side of the choke in case the choke needle need be replaced. A high-pressure valve was included in the sloping flow line so that all production could be diverted through the choke if desired. It was found that by opening the choke slightly more than the choke at the well head, most of the surging characteristics could be eliminated. While the extra equipment required to give these results was expensive due to its high-pressure construction, the possibility of a line failure or a fitting leak and other system damage was almost eliminated.

Constant Guardian

Against EXCESSIVE PRESSURES!

MODEL 412 RELIEF VALVE

Positive Protection for Pipe Line and Refinery Installations

Hydraulically operated, the Kinzbach Model 412 Relief Valve utilizes line pressure for opening and closing, with opening pressure determined through application of a dead weight load. *No springs are involved;* consequently, no factor of service or conditions can alter pre-determined settings.

Instantaneous opening to full capacity; automatic re-setting; positive seating; facilities for functional testing . . . these are a few of the other advantages provided by this valve.

For absolute safety and dependability, use them at strategic points on your hydraulic systems. They are available in 4", 6" and 8" sizes, for working pressures up to 1000 p.s.i.

Full information will be furnished upon request.

KINZBACH TOOL CO INC

KINZBACH TOOL COMPANY, INC.

P. O. BOX 277 HOUSTON, TEXAS

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PENBERTHY
REFLEX and TRANSPARENT
DROP FORGED STEEL LIQUID LEVEL GAGES

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REFLEX
Drop Forged Steel Liquid Level Gage
Empty Space Shows White
Liquid Shows Black

Due to "Reflex" principle, liquid always shows black and empty space white. Liquid level is indicated instantly and unmistakably. Made of temperature resisting alloy steel for high pressure and temperature service. Conforms with API and ASME requirements.

PENBERTHY
TRANSPARENT
Drop Forged Steel Liquid Level
GAGES

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel. Conforms with API and ASME requirements.

3277-C

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Arrange Oil and Mud Separators

While working a well over by swabbing, redrilling, washing the face of the sand or chemically treating the producing zone to increase production, oil lifted to the surface is usually accompanied by foreign matter, drilling mud, sand and water. To separate free oil from the undesirable matter, a series of tanks can be arranged so that each one in the series of three or four will have different heights in order to take advantage of gravity to recover the oil.

Each of the tanks is similar in construction and size, fitted with bails on the sides and ends for lifting with a rigging crane or truck boom when placing in operating position or removing for hauling elsewhere. The lowest tank is merely set on the ground surface, while the second is mounted on a short substructure approximately one-fourth the height of the tank. The next tank, which receives the mixture of mud and oil, is set on a still higher sub-structure, but only high enough to raise the top of this tank approximately the same distance above the middle one as it is above the one on the ground.

The swab line is led to the highest tank and discharges all oil and mud directly into the tank. Several four-inch outlets on the opposite side allow the oil to flow into the second tank while the heavier mud, sand, and water settle to the bottom. The flow of the mixture from the second tank to the third tank is identical and the relatively clean oil is discharged from the third tank into a shallow vessel where the pickup pump takes suction. Sedimentation in any of the tanks can be easily and readily removed with a conventional vacuum mud truck for hauling to disposal pits.

Gotkool
WATER CANS & COOLERS

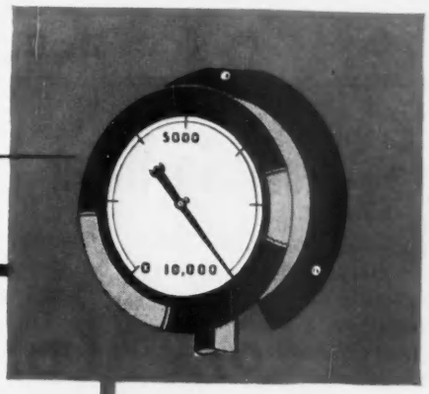
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push-Button Faucet at slight additional cost.)

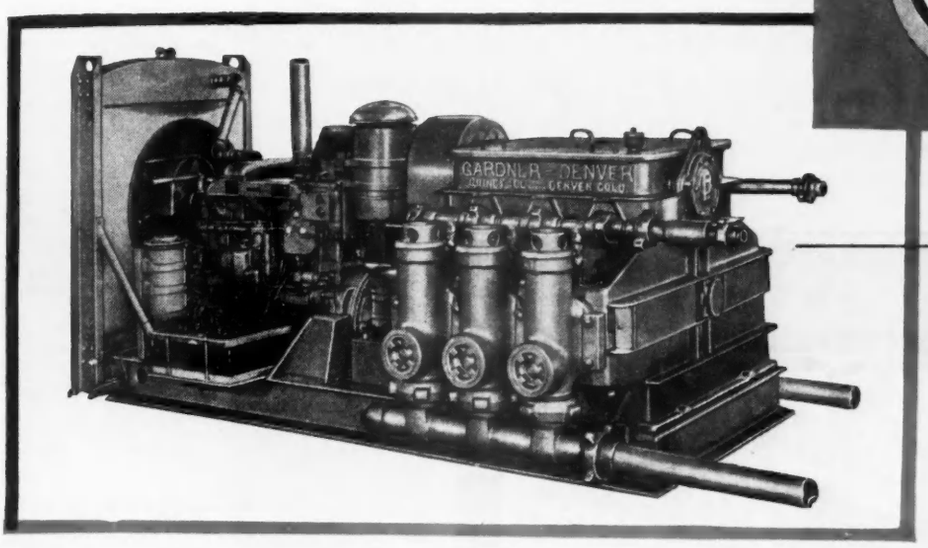
GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. GOTT Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today! . . . . . .

GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.

H. P. GOTT MFG. CO.
WINFIELD, KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY

strength for this





and stamina to finish the job

Gardner-Denver PL7 Super-Pressure Oil Well Service Pump

Built for squeeze pressures up to 10,000 pounds per square inch, the Gardner-Denver PL7 Super Pressure Oil Well Servicing Pump is designed with extra safety factors to see the job through to completion. The PL7 pumps more than 200 gallons per minute at 1,000 pounds per square inch pressure — or approximately 25 gallons per minute at 8,000 pounds pressure.

New Compactness — As a result of new principles of design, the PL7 pump is unusually compact and mobile. The six pump cylinders are arranged in two banks, as two triplex single-acting plunger pumps. One bank of three plungers is 3½ inches in diameter and the other bank is 4¾ inches in diameter, all using 7-inch stroke.

Unusual Flexibility — An exclusive feature of the PL7 pump provides a wide pressure and volume range. Pump may be operated on either bank, or on both banks at the same time. Low pressure work is handled at a volume of more than 250 gallons per minute, using all six plungers. High pressure work is done with either bank of three cylinders, and at reduced speed pump operates at 8,000 lbs. pressure, or up to 10,000 lbs. squeeze pressure.

Strong, Yet Lightweight — Extensive use of steel in constructing the PL7 assures ample strength for extreme operating conditions—keeps pump lightweight and easy to haul.

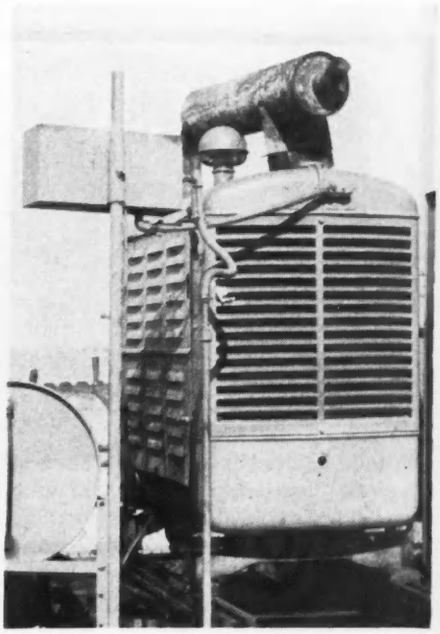
For complete information write Gardner-Denver Company, Quincy, Illinois.

Dallas • Houston • Tulsa • St. Louis • Los Angeles • San Francisco
New York • Chicago • Pittsburgh • Denver • New Orleans
Continental Supply Co., Continental Bldg., Dallas, Texas
Export Division: 30 Rockefeller Plaza, New York, N. Y.
Republic Supply Co. (of Calif.), 2600 S. Eastland Ave., Los Angeles, Calif.

GARDNER-DENVER SINCE 1859

HOW TO—Maintain Water Level in Pumping Engine Radiator

Water which evaporates from pumping engine radiators can be automatically replenished within a narrow level range by installing a small tank containing a float controlled valve. The tank is rectangular in shape and is simply a steel box, with or without a hinged cover, made of light steel with welded seams. Attached to one end of this tank are fittings for connecting small pipe, either one-fourth- or one-eighth-inch, which extends into the receptacle and terminates with a conventional threaded end. To this end of the small pipe is attached a common pinch cock similar to one used on the drain



of gauge glasses.

A ball float, with its arm soldered to the flat side of the cock handle, rides upon the water to open or shut off the cock as the level falls or rises to maintain a level equal to that desired in the engine radiator.

The tank is supported on a pipe standard by welding a ferrule to one side for adjustment as to height and which is locked in the required position with a set screw. The supply line for water to the tank has a short length of high pressure flexible rubber tubing to allow the adjustment for height to be made without pipe fitting. Water flows from the tank through a connection in the floor to the radiator of the engine by attaching a necessary length of tubing to reach to the radiator itself. To prevent constant overflow, the radiator inlet is attached to the upper tank by brazing a nipple into the shell in order to maintain a water level slightly below the normal overflow outlet.

FOR GREATER Safety AND LONGER Service

McKISSICK BUILDS A BETTER BLOCK

All forged steel load carrying members, Roller Bearings, and Alemite Lubrication make these blocks unique in their fields.

TONG BLOCK

Wide range of sizes and capacities. Easy insertion of Tong Line with Patented opening feature. Combination of machine grooved steel sheaves and roller bearings give sensitive performance.

HAY FORK PULLEY

All purpose Manila rope block. Handles up to 1¼" rope. One piece pressed steel housing flared to prevent rope chafing.

McKISSICK

McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

HOW TO—Control Tank Vacuum

When vapors are removed through pipe lines from production tanks not built for extreme pressure or vacuum, both the pressure and the vacuum can be positively controlled with a simple water sealed U-tube. The vapor line

No Guessing
WHEN YOU USE THE SIGNAL CLOSING SET SHOE

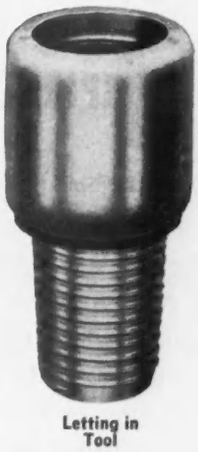
With the Layne "Tubing Set" Packer, the signal closing set shoe, screen liner and packer are run in the casing with the tubing connected in the set shoe and not the Packer.

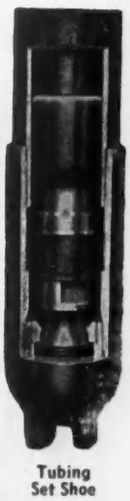
If the pump is run slowly while the valve is being closed, circulation will stop entirely when the valve is completely closed. When the "letting in" tool is released from the valve, circulation will start again.

You can make one trip into the hole do the job of two by using the Layne Tubing Set Packer.

Packer

Collapsing Tool


Letting in Tool


Tubing Set Shoe

THE LAYNE "TUBING-SET" Packer

Write for Complete Information

THE LAYNE AND BOWLER COMPANY

EXPORT:
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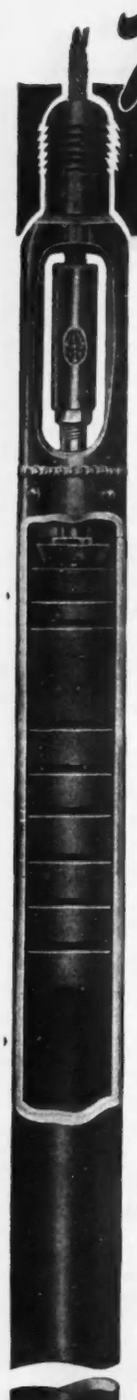
Room 1636
30 Rockefeller Plaza
New York, N. Y.

General Office & Factory
8000 MARKET STREET HOUSTON, TEXAS

WEST COAST:
Layne & Bowler Corp.
900 Santa Fe Ave.,
Los Angeles, Cal.



Miller

SAND PUMPS

Standard Clean-out Tool for 25 Years

Check any oil field in the world where sediment or sand is met with and you'll find Miller Sand Pumps and Bailers are standard . . . leadership earned and held by continuous improvements during 25 years of service!

The Miller Sand Pump is made in Regular and Heavy Duty types in sizes listed below. Lug type Chisel, Sand and Bailer Bottoms are easily interchanged.

Threaded Chisel and Sand Bottoms can be supplied, to permit larger pieces of sediment to pass, and pump to be dumped without removing bottoms. Tool Pin bail allows tools and sand pump to be run on same wire line when desired.

Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue page 2666 for details.

SAND PUMP AND BAILER SIZES:

Outside Diameter
2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths
20 feet
25 "
30 "

Special Sizes and Lengths to Order!

EXPORT OFFICE
30 Rockefeller Plaza
New York 20, New York

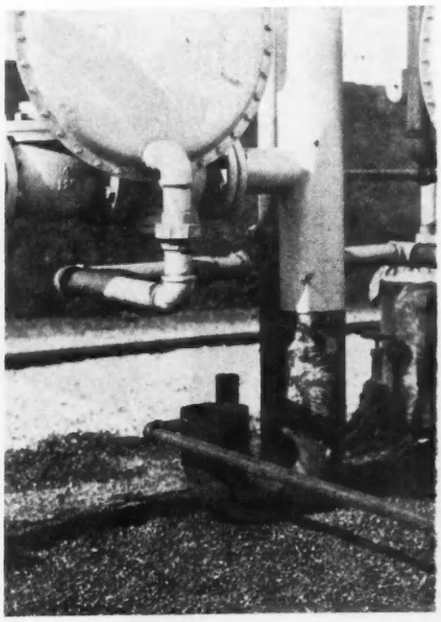
MILLER SAND PUMP CO.
1524 S. E. 29 • Box 4516
OKLAHOMA CITY 9, OKLAHOMA

PRODUCTION HINTS

leading from the battery of tanks contains fittings and attachments to control normal flow of vapors which operate successfully while the vapors are being removed by the gathering system. When a stoppage of flow is encountered, or excessive vacuum is built up, damage might be experienced if auxiliary protection was not built into the system.

One method of protecting the tanks from a surge of pressure or sudden vacuum is to install the water seal on the lower end of the vertical riser which forms part of the vapor system. The line illustrated is a six-inch pipe with a 180-degree welded return bend attached to the open bottom end. Without a seal, this would provide atmospheric pressure, but would allow vapors to escape or air to be drawn into the line. To seal the line, water is poured into the open end of the U-tube until the bend is filled which provides a certain number of inches back pressure, depending upon the length of the open end of the welded 180-degree ell.

If the line produces condensate under temperature conditions, an overflow is inevitable, but to withdraw this fluid, a



one-inch line is connected to the ell near the open end and leads to the drainage system which cares for tank bottoms and water so that the ell always contains a definite amount of fluid, unless a sudden surge of pressure blows the seal.

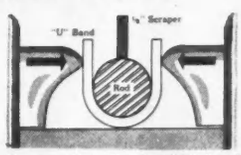
KEEP YOUR WELLS PUMPING!

Eliminate Paraffin Accumulation the LOW COST way with...

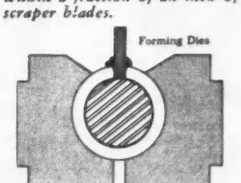
CRALL SPIRAL SCRAPERED RODS

CRALL Spiral Paraffin Scrapers fit any sucker rod. They are NOT welded to the rod (see illustrations at right), but stay firmly in position to keep tubing free from paraffin. CRALL Spiral Paraffin Scrapers are made to fit 2" and 2½" tubing, and can be attached to your sucker rods at our fabricating plants. The *original* installation is the ONLY cost.

Order from your Supply Store or Write or Wire Us for full descriptive literature.

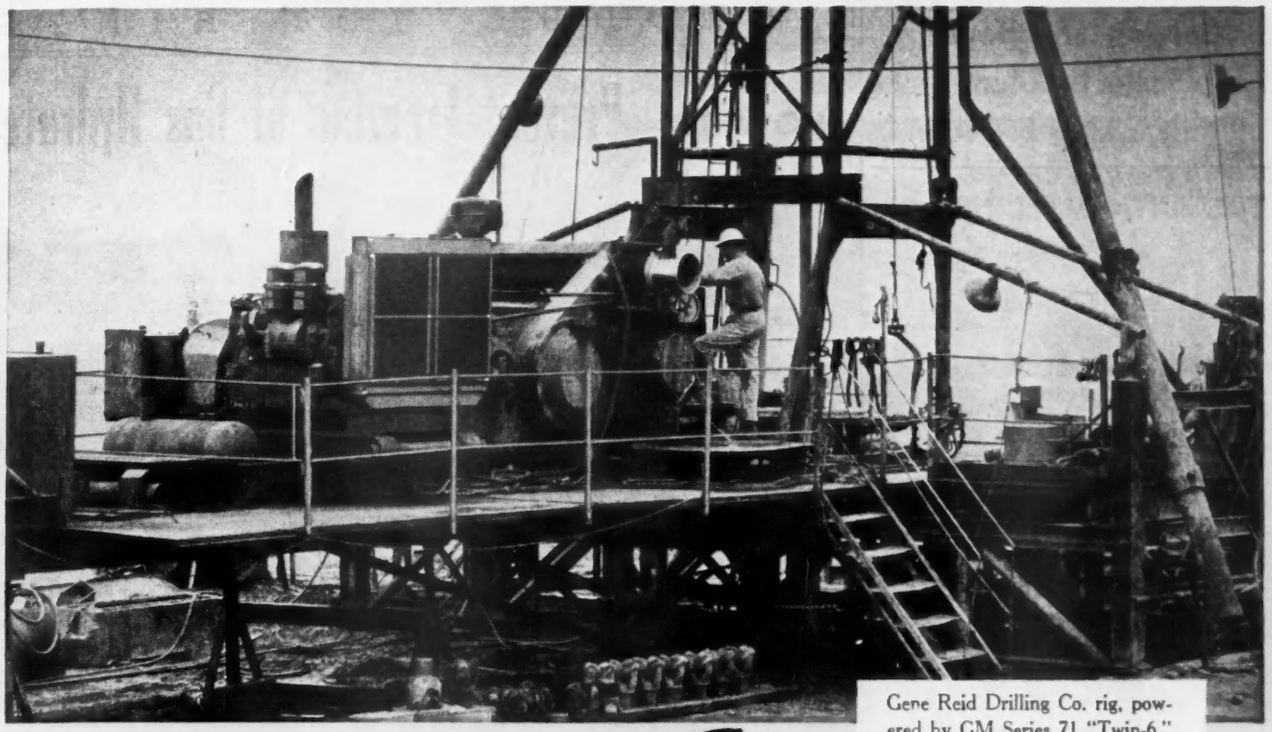


Cross section showing "U" band being die-formed around rod to within a fraction of an inch of scraper blades.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blade.

PETROLEUM SPECIALTY CO. Manufacturing and Fabricating Plants at Pampa and Levelland, Texas.
P. O. BOX 1640, PAMPA, TEXAS



Gene Reid Drilling Co. rig, powered by GM Series 71 "Twin-6." The unit consists of a McCarthy-Bender 96′ mast and Emsco 936 draw works, drilling near Tejon Ranch, California.

Round Trip IN HALF THE TIME

YOU can take the word of D. E. Crandall, maintenance superintendent for Gene Reid Drilling Co., Bakersfield, California, that a General Motors Series 71 Diesel engine has no equal for fast, dependable performance in drilling service. He reports:

"Since November 1947 our rig has drilled seven wells, averaging 4000 feet each. With our GM Twin we make a round trip in half the time—it never stalls and not one cent has been spent in repairs. You just can't beat a GM engine for oil well drilling!"

Men who use them know—GM Series 71 Diesel engines deliver the rugged, flexible power required for oil-well drilling. Two-cycle operation—power at every downstroke—makes them unusually powerful for their compact size and weight. They pick up loads fast and respond instantly to varying power demands.

Simplified design makes maintenance an easy matter. Sensible size and weight make it easier to rig up and cut moving costs.

Before you buy new equipment or repower old units, it will pay you to get the facts about GM Diesel power. *Write, wire or phone for details.*

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES... Up to 200 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS... Up to 800 H.P.

GENERAL MOTORS

GM GENERAL MOTORS DIESEL POWER

DIESEL BRAWN WITHOUT THE BULK

GENERAL MOTORS CORP., DIESEL ENGINE SALES, PETROLEUM INDUSTRY, 1504 Philtower Bldg., TULSA 3, OKLAHOMA

Anderson-O'Brien Co.
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Empire Machinery Ltd.
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West Coast Engine & Equip. Co.
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BILLINGS, MONTANA

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GREAT BEND, KANSAS (Dealer)

Mountain Tractor Co.
MISSOULA, MONTANA

Solving The Boiler Scale Problem With SAND-BANUM

THE ANTIQUATED METHOD

TOTAL WEIGHT-HUNDREDS OF POUNDS

BUT NOW

THE MODERN SAND-BANUM WAY

A 16-OUNCE CAN ALL ACTIVE INGREDIENTS

SAND-BANUM

Prevents

BOILER SCALE FORMATION
REMOVES OLD SCALE

In Safety
With Economy

The Proof Awaits Your Asking

"The Entirely Different Boiler and Engine Treatment"

AMERICAN SAND-BANUM COMPANY, Inc.
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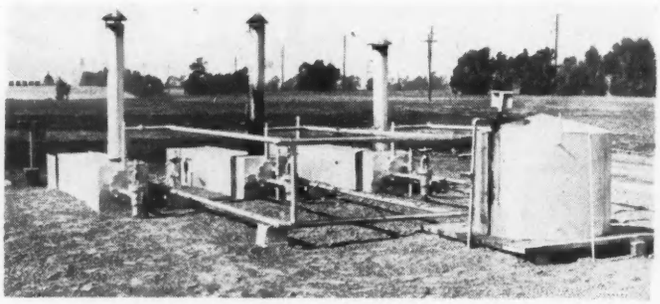
PRODUCTION HINTS

HOW TO—Prevent Freezing of Gas Hydrates



In the production of high-pressure gas, particularly where there are hydrates in the gas, the problem of freezing at any point in the line where the pressure is reduced is important. In one high-pressure gas field, gas flow lines from three wells on one lease were brought to a central point where the lines were heated on the downstream side of the pressure chokes. The flow line chokes may be seen in front of each heater. Gas enters the heat exchanger near the bottom of the flange at the head of the exchanger and discharges from the heater near the top of the flange. Gas then flows to metering stations and into the gas mains.

The exchangers are of the indirect type, with gas tubes surrounded by hot water. While each unit operates independently of the other, they are all supplied makeup water from a common source, which is the tank shown at right. Each heat exchanger is surrounded by a fire brick enclosure having an opening at the near end to accept a short stack. Fuel for the burners in each heater comes from the field system through a thermostatically-controlled regulator. Dampers in each stack control the fire under the heaters. The firebox of each heater is located at the far end and is protected from the wind by metal enclosures.

Water in the heat exchangers is main-

RICE PUMPS *Have Everything* for Dependable Pump Performance!

Every RICE PUMP carries an A.G.C. Rating Plate.

RICE self-priming centrifugal pumps embody *proven* developments in pump design . . . features that set high standards in centrifugal pump performance:

- **AUTOMATIC PRIMING** — simply fill pump body and start engine. Pump primes automatically thereafter.
- **DIRECT LINE FLOW** — liquid flows through suction opening to impeller in direct line. Large openings, no sharp turns, minimum friction.
- **SUCTION CHECK VALVE BUILT-IN** — holds liquid in pump for re-priming. No foot valve needed in hose.
- **SELF-LUBRICATED SHAFT SEAL** — Biggest improvement in pump seals in a decade. Entire seal enclosed in welded, pressed steel cartridge. Quickly and easily replaced.
- **NON-CLOGGING IMPELLER and WEAR-PLATE** — Rice Pump impellers are of the open type; handle liquids with a high percentage of solids. Hardened steel wear-plate and impeller replacable when worn.

Write for New Illustrated Bulletin on 2", 7M and 10M models, the two most popular sizes of centrifugal pumps for the construction and oil field industries.

RICE PUMP & MACHINE CO.
Division of Milwaukee Chaplet & Mfg. Co.
1047 S. 40th St., Milwaukee 4, Wis.

RICE *Self-Priming* CENTRIFUGAL PUMPS

A 5560-⅛

. . . BIG STEP FORWARD

a safer method of setting one, two, three, or more, Otis Sub-Surface Controls at desired depths in a single string of tubing!

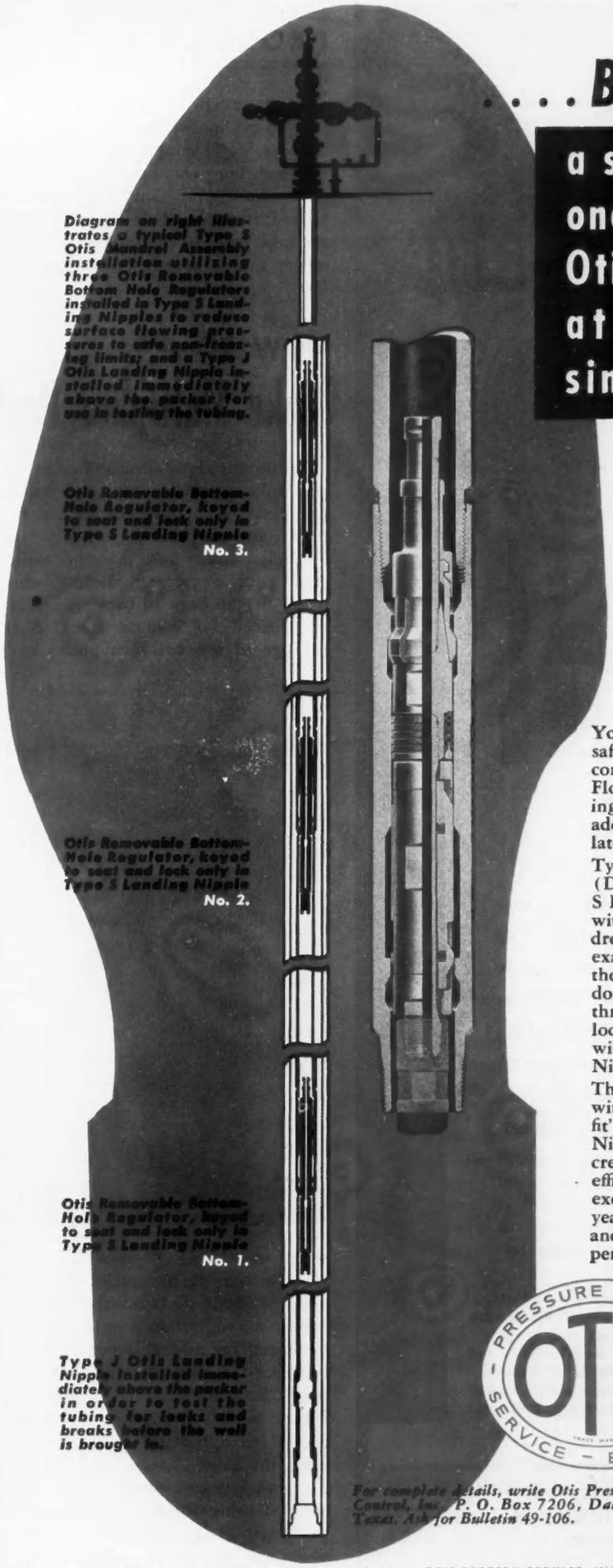


Diagram on right illustrates a typical Type S Otis Mandrel Assembly installation utilizing three Otis Removable Bottom Hole Regulators installed in Type S Landing Nipples to reduce surface flowing pressures to safe non-freezing limits; and a Type J Otis Landing Nipple installed immediately above the packer for use in testing the tubing.

Otis Removable Bottom-Hole Regulator, keyed to seat and lock only in Type S Landing Nipple **No. 3.**

Otis Removable Bottom-Hole Regulator, keyed to seat and lock only in Type S Landing Nipple **No. 2.**

Otis Removable Bottom-Hole Regulator, keyed to seat and lock only in Type S Landing Nipple **No. 1.**

Type J Otis Landing Nipple installed immediately above the packer in order to test the tubing for leaks and breaks before the well is brought in.

new TYPE S MANDREL ASSEMBLIES installed in TYPE S LANDING NIPPLES

Your next high-pressure well can have simpler and still safer sub-surface control. One, two, three, or more new corrosion-resistant Type S Otis Landing Nipples (and Flow Couplings), run at desired intervals with the tubing, will afford definitely located seats for landing an adequate number of Otis Removable Bottom Hole Regulators, Tubing Safety Valves, and Bottom Hole Chokes.

Type S Otis Landing Nipples are essentially full-opening. (Drift diameter of 2" tubing = 1.901"; I. D. of 2" Type S Landing Nipple = 1.875".) Each Nipple is "profiled" within its bore to accept only one specific Type S Mandrel Assembly having a matching set of "keys." For example, the Type S Mandrel with #1 keys, and carrying the desired sub-surface control mechanism, can be run down the tubing under pressure on a steel measuring line through all upper Type S Landing Nipples, to select and lock positively only in Type S Landing Nipple #1. Likewise, the Assembly having #2 keys can be set only in Nipple #2, etc.

The new Type S Otis Mandrel Assemblies are equipped with fully-supported V-type packing which effect a "slide fit" within the machined bore of the Type S Landing Nipple to eliminate the necessity of flowing the well to create an initial shutoff, and are constructed with an efficient metal-to-metal locking mechanism. These two exclusive design features have been used successfully for years (in Type J Otis Mandrel Assemblies) to pack-off and lock Otis Sub-Surface Controls under extreme temperature and pressure conditions.

PRESSURE CONTROL - OTIS - SERVICE - EQUIPMENT

OTIS PRESSURE CONTROL, INC.

TYPE S MANDREL ASSEMBLY

For complete details, write Otis Pressure Control, Inc., P. O. Box 7206, Dallas, Texas. Ask for Bulletin 49-106.

(T-2S)

DISTRIBUTORS: **OTIS PRESSURE CONTROL, INC.**, DALLAS, TEX.; **OTIS EASTERN SERVICE, INC.**, BOLIVAR, N. Y.; **WESTERN PRESSURE CONTROL**, LOS ANGELES, CALIF. FIELD OFFICES: **TEXAS:** HOUSTON, CORPUS CHRISTI, FALFURRIAS, VICTORIA, ODESSA, and LONGVIEW. **OKLAHOMA:** OKLAHOMA CITY. **LOUISIANA:** NEW IBERIA. **MISSISSIPPI:** BROOKHAVEN EXPORT SALES AND SERVICES: **OTIS PRESSURE CONTROL EXPORT, INC.**, POST OFFICE BOX 7206, DALLAS, TEXAS, U. S. A.; CARACAS, SOUTH AMERICA MANUFACTURE AND DEVELOPMENT: **OTIS ENGINEERING CORPORATION**, POST OFFICE BOX 7206, DALLAS, TEXAS, U. S. A.

THERE'S ONLY

One

ROLO WELLCHECKER

Introducing New
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PRODUCTION HINTS

tained at about 150° F. through a thermo-syphon system connected to the makeup water supply tank. One pair of two-inch lines connects each heater with the water supply tank. As the water is heated, it rises and flows slowly back to the tank through the top line. Cool water enters the exchanger through the lower line.

HOW TO—

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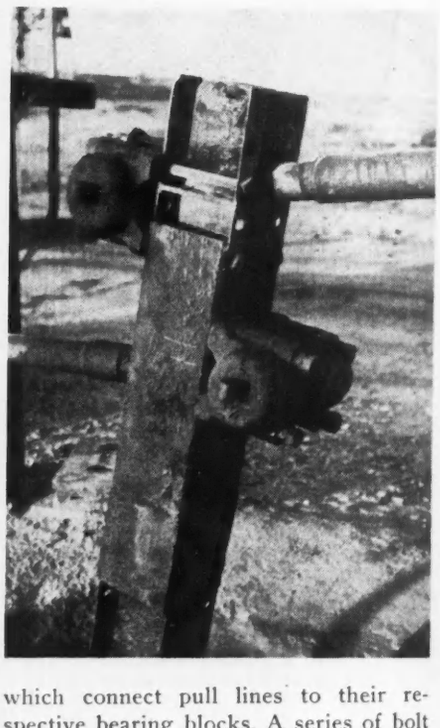
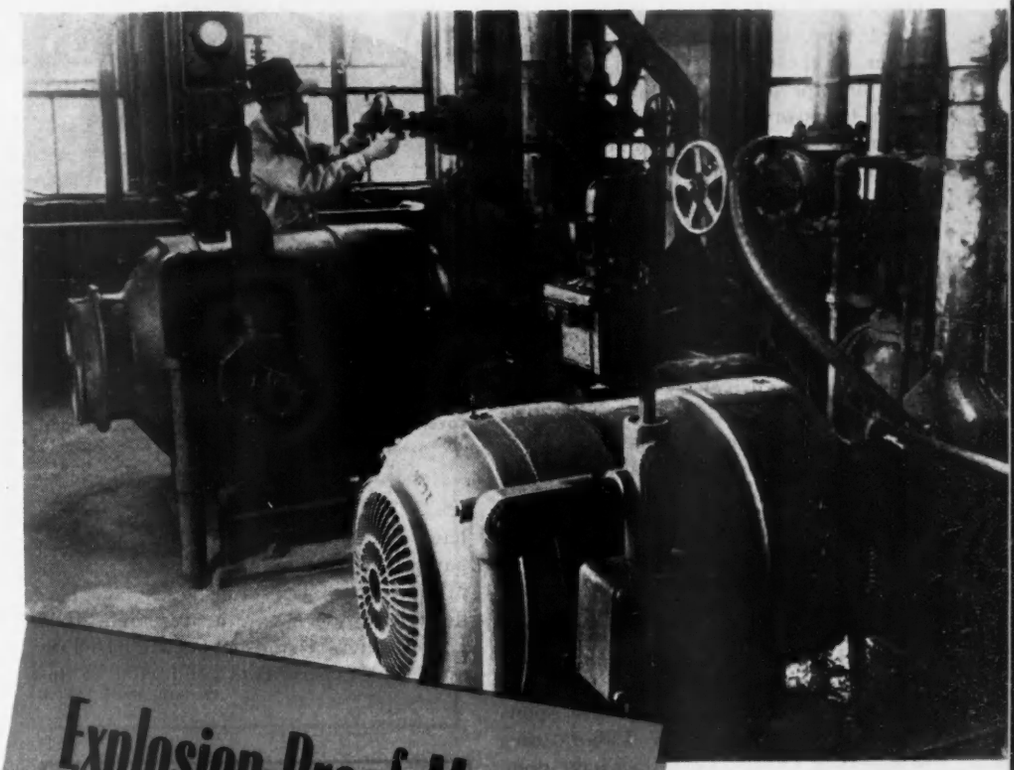


which connect pull lines to their respective bearing blocks. A series of bolt holes drilled at two-inch intervals is drilled through the channel side members, and for added strength, rectangular pieces of steel plate are welded over the channels along this interval as shown in the photograph. Properly anchored to a bearing set in a concrete base, the post is amply strong to take the load imposed upon it. The convenience of being abel to adjust very closely the length of stroke of the well, together with hte degree of multiplication desired, repays its cost of fabrication in a short while.

By F. G. GEIGER
Manager Sales and Engineering,
Norwood Works, Allis-Chalmers



Two 100 horsepower explosion-proof type motors driving butane pumps at an Indiana installation.

Explosion-Proof Motors

In Pipe Line Operations

A COROLLARY of the nation's expanding electrical industry is its more widespread use in the production and movement of petroleum and its products. The trend toward electrification accelerated considerably during the past two decades, notably in pipe line operations. An example of the success of this type of power was afforded during the last war when the "Big Inch" pipe lines were equipped with electrically operated pump stations and other electrically-driven equipment. The record proves that results were most satisfactory and in a great measure contributed to the success of this vital operation. It is the purpose of this article to discuss only the use of power in the oil distribution field and then only in connection with electric drive of pipe line pumps.

HANDLING OF LPG or other high volatile liquids with motor-driven centrifugals demands adequate provision against fire and explosion. The author discusses the term "explosion-proof" as applied to pipe line motors, and demonstrates how safety can be insured through use of properly designed and installed driving units.

Some advantages of electric power in pipe line operations may be briefly stated as follows:

A. The electric motor goes hand in hand with the high speed centrifugal pump by means of direct coupling.

B. Electric motors permit the operation of an automatic station, or one remotely controlled, and thus reduce operating costs.

C. Electric motors and high speed centrifugal pumps materially reduce the building costs of a pumping station.

D. Electric power permits the installation of outdoor, or semi-outdoor, stations, where other conditions such as climate may be suitable.

E. A fine job done by public utilities in increasing reliability of operation, and by inter-connecting stations to assure continuous operation, makes the modern electrical-driven equipment reasonably free of shutdowns.

The utilization of electric power is, of course, largely through the use of electric motors, and entirely so when the electric power must be converted into mechanical energy. Electric motors are available for use with direct current and with alternating current. The alternating current, polyphase motor is further available in synchronous, wound rotor induction, and squirrel cage induction types. Any of these three could be adapted to pipe line pumps. This article will discuss only the squirrel cage type, as it is currently the most commonly used and it appears that it will maintain its position due to relative simplicity and lower initial cost.

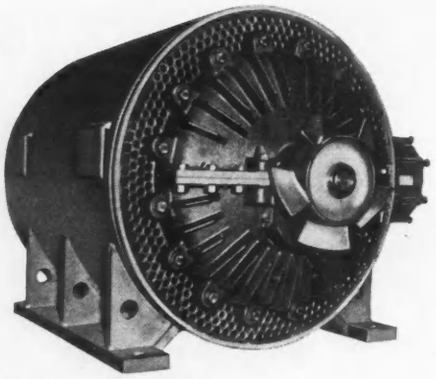
The squirrel cage motor is built with various types of mechanical enclosures, the simplest being the standard open

motor, and the slightly more complicated type, the splash-proof motor. If either of these two types of motors is used on pipe lines, it is probable that in order to assure safety, and to keep the electrical equipment away from the inflammable liquids, the motors would have to be placed in one room and the pumps in an adjacent room. This involves the building of extra partitions, a somewhat larger building, and a certain amount of trouble with stuffing boxes through the partition. It is suggested that the handling of inflammable liquids should be through pumps driven by explosion-proof motors. The danger of applying electric motors and control in areas where explosive gases and combustible liquids may be present has long been recognized by the electric motor manufacturing industry. There was some reluctance, however, to invest money to develop the line of motors providing adequate inherent protection until suitable and acceptable standards had been developed. Credit should be given to the National Board of Fire Underwriters, under whose sponsorship the Underwriters' Laboratories is operated, for the work they have done after painstaking research in establishing a set of standards with which motor designers can work with confidence, and which users could apply to their purchases with equal confidence. The specifications covering Underwriters' Class 1, Group D, and Class 2, Group G, motors are widely accepted, even by domestic companies who are self-insured and by foreign purchasers who do not insure with American insurance companies.

It is perhaps unfortunate that motors built to these specifications are generally simply known as "explosion-proof." This has led to some erroneous conceptions as to the construction of such motors. There is some evidence that there are individuals who have the impression that a Class 1, Group D, motor is one that is proof against explosions outside, but in close proximity to it; there are others, and they are many, who have the impression that an explosion-proof motor is an air-tight machine and consequently no explosive mixtures can, under any conditions, enter the motor.

To clear up this misconception, particularly the latter, it is well to quote from Article 500 of the 1947 edition of the National Electric Code, which, under sub-article 5001, states: "The term 'explosion-proof' as used in this article shall mean: enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes, or explosions of the gas or vapor within."

An explosion-proof motor, built to the Underwriters' specifications, must have minimum lengths of fits between parts, and certain maximum tolerances in dimensions as established by the Underwriters after careful research. The Underwriters' requirements are based on numerous experiments conducted to determine the pressures produced by various mixtures of gases when ignited, and the length and clearances of joints have been determined so that any internal burning will be sufficiently cooled so that it will not ignite the surrounding atmosphere. Actual tests under these conditions are performed in the Underwriters' Laboratory in Chicago before approval of a new design is given. If, however, the motor design engineer had only these limitations to worry him, his task would be comparatively simple. He has the additional problem of heat dissipation to consider which becomes more complex as the motor horsepowers increase.



Tubular type explosion-proof motor with end cover removed to show bearing housing and external fan.

In order to keep the size and cost of explosion-proof motors to a level where industry can afford their purchase, some means other than simple radiation for heat dissipation must be incorporated in sizes over approximately two horsepower. This is done by fan-cooling. The conventional method utilizes an enclosure with a double shell, air being forced through the opening formed by these shells by means of an external fan mounted on one end of the motor. In the larger sizes, including ratings such as usually required on pipe line pumps, additional treatment is advisable, as the effective area for heat dissipation does not keep step with the increase in hp. For example, a 125-hp motor has approximately seven times the surface area of a one hp motor, but must dispose of approximately 55 times the losses that occur in the smaller machine. To illustrate further, a motor is essentially a cylinder. Hence its volume; that is, its electrically-active material, increases as the square of its diameter and the first power of its length, whereas its surface increases only as the first power of each dimension.

The tube type method of heat transfer is one method of additional treatment employed in dissipating the heat created by power losses in the motor. In effect, this design is simply a totally-enclosed motor around which is wrapped a simple air-to-heat exchanger. This heat exchanger is of the conventional tube type. Internal fans built into the motor rotor circulate the inside air through the electrically-active parts of the motor and around the outside of these tubes. This internal air picks up the motor losses. in the form of heat, from the stator and rotor cores and their windings.

An outside fan forces the external air through the inside of the tube at a fairly high velocity. The heat conducted through the walls of the tube is transferred to this external air and dissipated into the atmosphere.

This sounds like a rather simple principle, and it is just that. However, dur-

■ CONTINUED ON PAGE 198

About the Author

F. G. GEIGER, manager of sales and engineering of Allis-Chalmers Norwood Works electrical section, entered the employ of Allis-Chalmers in 1913 as sales correspondent in the New York office. In 1916 he accepted a position in the purchasing department of American Smelting & Refining Company, New York. The same year he joined the U. S. Army and served with the American air force in France.

At the conclusion of World War I he returned to Allis-Chalmers as a salesman in the New York office. In 1938, he was named assistant manager of sales, Norwood Works, and subsequently was appointed assistant manager of the Electrical department at the Norwood Works and still later to his present post.

Equation for Optimum Pipe Size With Viscous Flow

By ERNEST LONG
Department of Chemical Engineering,
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DETERMINATION of pipe size for suction lines and other systems where conditions of viscous, rather than turbulent, flow may hold, is a function of fluid viscosity. This factor is utilized by the author to develop a formula which enables pipe sizes to be determined without approximations. The formula relates costs and amortization time to pipe size under set flow factors.

THE subject of economic pipe diameter has been treated in articles by Genereaux[1, 2] and Sarchet and Colburn.[3] Genereaux, however, treated the subject of viscous flow only slightly. The results presented here represent in the author's opinion a new approach to the subject. This article is primarily concerned with the relation of optimum diameter and viscosity of petroleum in the viscous flow region over the pipe diameter range of five to 18 inches.

With fixed conditions of cost of pipe and pumping energy, volumetric flow rate, and pipe diameter, the cost or pressure drop for turbulent flow is a function of fluid density and fluid viscosity. In viscous flow, however, it is a function of fluid viscosity alone. The results in this paper were obtained by utilizing this simpler relation.

The final equations given here were developed as tabulated.

As the total cost for transporting the fluid is the sum of the energy cost (pumping cost) and the installed pipe cost, we formulate the following equation for viscous flow ($Re < 2100$):

$$T.\ C. = (k\ L\ R^2\ Y\ a\ u)/(D^4) + (b\ k'\ L) \quad (8)$$

Total Cost = Pumping cost + pipe cost,
in which

- Y = amortization period in years, replacing θ in Equation (7b),
- R = volumetric rate of flow in barrels per day, replacing q in Equation (7b),
- a = pumping energy cost rate in cents per delivered horsepower-hour,
- b = pipe cost in dollars per installed mile,
- k and k′ = collection of constants and conversion factors, and
- T. C. = total cost in dollars for transporting R barrels per day of fluid of viscosity u through L feet of pipe of diameter D feet continuously over the amortization period of Y years for cost conditions of a and b.

The relation between viscosity and optimum pipe size (minimum total cost) is best determined by determining the viscosity at which the total costs of two successive pipe sizes are the same. This viscosity is hereafter termed the "critical viscosity" and is designated by the letter X. The significance of the critical viscosity is that for a viscosity greater than the determined critical viscosity the larger of the two pipe sizes is the more economical, and, correspondingly, for a viscosity less than the critical, the smaller pipe is the cheaper. The smaller pipe will be designated by m and the next larger pipe by the subscript n.

Equating the total cost equations for two consecutive pipe sizes and solving for the critical viscosity X, there results

$$X = (b_n - b_m)\ (k'/k)\ (1/R^2\ a\ Y)\ (D^4_n)\ (D^4_m/(D^4_n - D^4_m)) \quad (9)$$

Now if the following substitutions are made

$$S = (10^{-3})\ (b_n - b_m)/(d_n - d_m) \quad (10)$$

$$F = (d^4_n)\ (d^4_m)/(d^2_n + d^2_m)\ (d_n + d_m) \quad (11)$$

$K\ (k'/k)\ (10^{-3})/(12^4)$, and
$d = 12\ D$ = pipe diameter in inches,
the equation that results is

$$X = K\ F\ (S/R^2\ a\ Y). \quad (12)$$

Thus it is seen that the critical viscosity is uniquely determined by the two group factors F and $(S/R^2\ a\ Y)$. The factor F, as defined above, is determined solely by the pipe diameters in question, whereas the term $(S/R^2\ a\ Y)$ is a grouping of the cost and flow conditions. The term S, defined above as the difference in cost in thousands of dollars per installed mile of pipe of two successive diameters divided by the difference in pipe diameters in inches, is hereafter termed the "point-to-point pipe cost

Turbulent Flow		Viscous Flow	
$P = (2\ f\ L\ V^2\ \rho)/(g\ D)$	(1a)	$P = (32\ u\ L\ V)/(g\ D^2)$	(1b)
$f = 0.04(Re)^{-0.16}$	(2a)	$f = (16)/(Re)$	(2b)
$Re = (D\ V\ \rho)/(u)$	(3)		
$V = (4\ q)/(\pi\ D^2)$	(4)		
$P = \dfrac{(0.00388\ L\ \theta\ q^{2.84})}{(D^{4.84})}\ (\rho^{0.84}\ u^{0.16})$	(5a)		
		$P = \dfrac{(1.266\ q\ L)\ (u)}{(D^4)}$	(5b)
$E = P\ \theta\ q$	(6)		
$E = \dfrac{(0.00388\ L\ \theta\ q^{2.84})}{(D^{4.84})}\ (\rho^{0.84}\ u^{0.16})$	(7a)		
		$E = \dfrac{(1.266\ q^2\ L\ \theta)\ (u)}{(D^4)}$	(7b)

where P = pressure loss or drop in pounds per square foot,
E = energy delivered to fluid in foot-pounds,
L = length of flow line in feet,
V = fluid average linear velocity in feet per second,
D = pipe diameter in feet
u = fluid absolute viscosity in pounds per foot-second,
q = volumetric rate of flow in cubic feet per second,
θ = time interval of flow in seconds,
f = Fannin friction equation factor, dimensionless. Equation 2a for the friction factor in turbulent flow is an empirical equation proposed by Genereaux.[1]
Re = Reynolds number, dimensionless, defined by equation (3),
π = universal constant, dimensionless and equal to 3.1416,
g = gravity constant = 32.16 feet per second, and
ρ = density, pounds per cubic foot.

slope." The term is just what its designation implies, representing the slopes of a broken-line plot of cost in thousands of dollars per installed mile of pipe versus the pipe diameter in inches. This permits the immediate use, with no approximations, of pipe cost data and does not necessitate the laborious task of fitting the cost data to an approximation equation. Such equations are usually in the form $C \cdot d^n$, where C is the cost of one-inch pipe. These equations are often useful over short ranges of diameter once the appropriate value of n has been determined. A change in cost conditions, however, usually requires the tedious re-evaluation of n. A cost relation such as $C \cdot d^n$ is, at its best, only an approximation. Differentiation, by the calculus of infinitesimals, of such a relation, which is one of finite (and often irregular) differences, will often be in error. The use of the "point-to-point pipe cost slope," S, involves no approximations and no tedious calculations. It may be quickly calculated mentally, thus permitting easy adaptation to new cost conditions.

In equation (12) K is $(1.088)(10^4)$ when the viscosity is in pounds per foot second and is $(1.619)(10^7)$ when the viscosity is in centipoises.

$$X \text{ (pounds per foot-second)} = (1.088)(10^4)(S/R^2 a Y)(F) \quad (13a)$$

$$X \text{ (centipoise)} = (1.619)(10^7)(S/R^2 a Y)(F) \quad (13b)$$

For convenience the values of F in equations (13a) and (13b) have been calculated and tabulated in Table 1.

Illustrative Uses of Equations (13a) and (13b)

Data given:
Amortization period: 5 years
Pumping energy cost rate: 2 cents per delivered horsepower hour
Volumetric flow rate: 10,000 barrels per day
Fluid viscosity: 60 centipoises = 0.0404 pounds per foot second

Pipe cost data:

Pipe size, inches	Dollars per installed mile
5	6,300
6	7,000
7	7,600
8	8,300
9	8,800
10	9,800
12	11,800

Data desired:
(a) Optimum pipe size.

TABLE 1

Evaluation of F in Equations (13a) and (13b)

Pipe Diameters (in inches)	$F = (d^4_n)(d^4_m)/(d^4_n - d^4_m)$
5-6	1,207
6-7	2,816
7-8	5,802
8-9	10,902
9-10	19,078
10-12	38,629
12-14	90,112
14-16	185,650
16-18	349,170

Explosion-Proof Motors

• CONTINUED FROM PAGE 196

ing the course of development of motors embodying this system of heat transfer many complex problems of design and manufacturing details have been encountered. For example, what internal construction would best meet the anticipated pressures produced by internal gas explosion? How many and what size tubes are necessary for proper heat dissipation? In the case of sleeve bearing motors, what type of flame arrestor would give necessary flame-arresting length of path, and how, with a diametrical clearance limited by the Underwriters' standards, could it be designed and assembled to compensate for bearing wear? Successful solution of these problems is demonstrated by the number of 400 hp, 3600 revolutions per minute motors of this design now being placed in service on a major pipe line.

This particular design of motor is largely self-cleaning in that the velocity of air through the tubes is fairly high. Should a peculiar operating condition exist which would contain a dust tending to adhere to the smooth inner walls of the tube, it should be noted that the tubes are perfectly straight and therefore can be cleaned as readily as the bore of a shotgun.

As previously mentioned, the Underwriters' standards for explosion-proof enclosures recognize the necessity of tolerances of fits or joints for parts used in the complete motor assembly, and particularly such parts as must be separable to facilitate motor maintenance. This, therefore, denies the existence of an air-tight enclosure. Consequently, an interchange of inside and outside air is perfectly possible and, in fact, almost certain. Under variations in temperature, either due to changes in ambient temperature or by cooling of the motor during shutdown periods, a small amount of the external air will be drawn into the motors. If the surrounding air is highly humid, alternate periods of idleness and operation may produce sufficient condensation to flood the stator windings in the bottom of the motor. Fortunately, approved drain valves are available which automatically permit condensed moisture to drain as it forms and without impairing the "explosion-proofness" of the motor. It is recommended that such drains be specified, especially where the motors may operate in areas of high humidity. Another form of protection is to install space heaters inside the motor so as to maintain a temperature above the dew point when the motor is idle. When space heaters are used, the control must be so arranged that either the space heaters are under thermostatic control or preferably that they be connected immediately that the motor is disconnected from the line. Motor manufacturers are familiar with either of these devices and would be glad to supply them if they are included in the specifications.

The choice of an explosion-proof motor versus an open motor is a matter of cost. The writer believes it is possible to adapt an open motor to any application, even those in hazardous atmospheres. However, cost studies will show that the additional expense of isolating an open motor from the hazardous atmosphere will more than offset the higher initial cost of the explosion-proof motor.

Solution:

$Y = 5$; $a = 2$; $R = 10{,}000$; $R^2aY = 10^9$
$S_{6-7} = (10^{-3})(7{,}600 - 7{,}000) = 0.6$;
$F_{6-7} = 2{,}816$
$X_{6-7} = (1.619)(10^7)(2{,}816)(0.6)(10^{-9}) = 27.3$ centipoise.

Therefore, the six-inch pipe can be used only for viscosities less than 27.3 centipoises and the seven-inch pipe can be used only for viscosities greater than 27.3. But it must be determined at what viscosity the eight-inch pipe becomes the optimum.

$X_{7-8} = (1.619)(10^7)(5.802)(10^3)(0.7)(10^{-9}) = 65.6$ centipoises.

Thus, for a viscosity of 60, which is between 27.3 and 65.6, it is seen that the optimum pipe size is seven inches.
(b) With the conditions of (a), at what flow rate does the eight-inch pipe become the optimum?

Solution:

$(R^2)/(10^4)^2 = (65.6)/(60.0)$
$R = 10{,}450$ barrels per day.

(c) With the conditions of (a), if the amortization period is changed to seven years, what is the effect on the optimum pipe size?

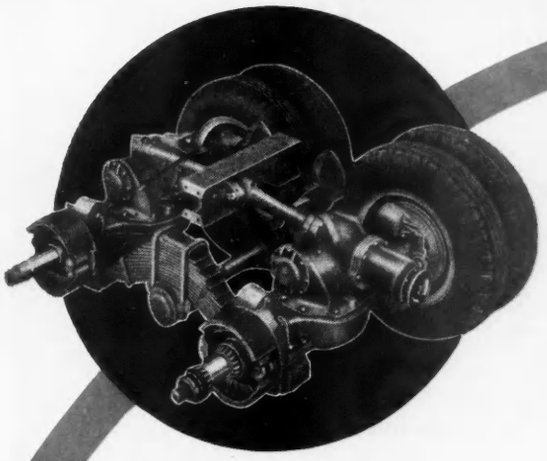
Solution:

$X_{7-8} = (65.6)(5/7) = 47$ centipoises.
$X_{8-9} = (1.619)(10^7)(10{,}902)(0.5)(10^{-9})(5/7) = 63$ centipoises.

Therefore, the eight-inch pipe is the optimum.

REFERENCES

[1] Genereaux, R. P., Ind. Eng. Chem., **29**, 285 (1937).
[2] Genereaux, R. P., Chem. and Met. Eng., **44**, 385 (1937).
[3] Sarchet, B. R., and Colburn, A. P., Ind. and Eng. Chem., **32**, 1249 (1940).



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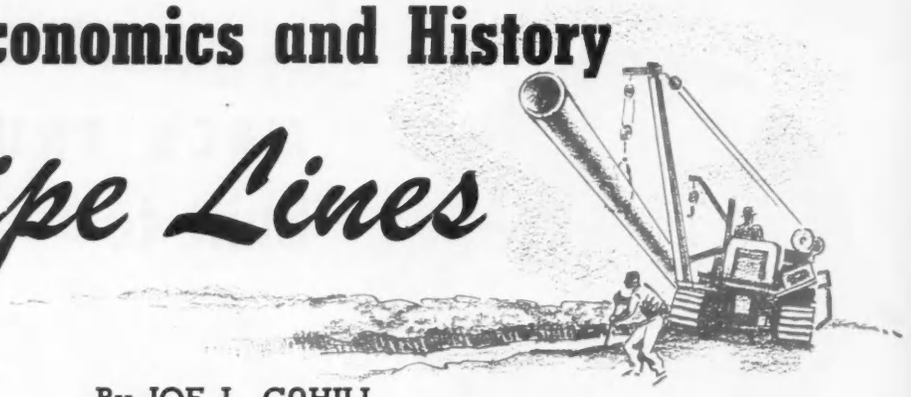
Engineering Economics and History of Pipe Lines



By JOE L. CAHILL
Chief Engineer, Pipe Line Department,
Continental Oil Company, Ponca City, Oklahoma

SUMMARIZING THE economics side of pipelining, which the engineer must know if he is to utilize his operation most efficiently, the author discusses regulation and analyzes its effect on maximum utilization of the system. The paper was read originally before the Mid-Continent Section, ASME, at a meeting in Tulsa.

WHEN the modern petroleum industry was born with the drilling of the Drake well in Titusville, Penn., in 1859 the problem of transportation arose. The first movements were by water, and wooden tubs were fastened to flatboats or barges and floated to their destinations. This method was slow, and even for those times, expensive. Later the same type of tub was mounted on railway flat cars and the economics of transportation became a science in the oil fields.

Barge transportation was undependable and unsafe and fully 30 percent of the cargoes were lost either from collision, fire or upsetting in the swift Pennsylvania rivers leading to the markets at Pittsburgh. Rail transportation at that time, while safer than the river boats, was still slow and unreliable. It was inevitable that one of those shrewd petroleum pioneers should think of pumping oil through a pipe from well to refinery stills.

First Pipe Line

In 1865 the first pipe line, four miles long, was laid in western Pennsylvania. In 1875, a 60-mile, four-inch line was laid from western Pennsylvania to Pittsburgh. There is little information on the development of these early lines, but the records show that in 1879 there were more than 700 miles of trunk and gathering lines. In 1880 this mileage had nearly doubled. In 1890 the total mileage was 5390, an increase of nearly 450 percent. From this small beginning came the great sprawling interlocking network of crude and products pipe lines we know today.

In 1923 there were 64,760 miles of pipelines, of which 51.2 percent or about 33,000 miles were trunk lines.

While at the present time I do not want to bring in a lot of statistics which in themselves are meaningless and which probably will not be remembered anyhow, the economics of pipe line operation are so dependent upon various governmental restrictions that some statistics will be necessary in order to make clear the present predicament of the pipe lines, and to demonstrate the growth of the pipe line in the economic development of the oil industry as a whole. These statistics have been gathered from "Petroleum Facts and Figures," issued by the Bureau of Information of the API and from "Statistics of Oil Pipe Line Companies Reporting to the Interstate Commerce Commission," prepared by the Interstate Commerce Commission. Up to 1945 we have been able to obtain from the API figures representing all pipe line companies, both intrastate and interstate; but since that time only those reporting to the Interstate Commerce Commission have been available. Pipe lines engaged in interstate commerce are common carriers and are therefore required to report all their operating figures to the Interstate Commerce Commission quarterly. Those pipe lines which are operating entirely within a state are not under the jurisdiction of the Interstate Commerce Commission and are therefore not obliged to report their income or any operating statistics. This gives rise to the discrepancy between the 1945 total pipe line miles and the 1947 figure which you will undoubtedly notice when the comparisons are quoted.

The first record of products line mileage appeared in 1928 when the Bureau of Mines listed 250 miles of products trunk lines. This undoubtedly represents for the most part converted crude lines. In 1940 this figure had risen to 9000 miles, while the total for crude lines rose to 116,900 miles, of which 62,400 miles or about 53½ percent were trunk lines.

Mounting Investment

The above figures represent the pipe line mileage of 66 pipe line companies with a combined investment in carrier property (ICC valuation) of $841,976,902 and a total throughput, during this year, both products and crude oil of 958,302,690 barrels. In 1942, the first war year, there were 69 pipe line companies involved in interstate transportation of petroleum and petroleum products whose ICC valuation amounted to $918,847,714 and who transported 1,073,800,382 barrels of crude and products. In 1945, the total investment in pipe line transportation properties amounted to $1,042,522,828, while the total pipe line revenues from all sources were $304,268,132, representing 2,379,243,526 barrels of crude and petroleum products delivered through 141,887 miles of trunk line and gathering systems. In this year there were 67,003,259 ton miles of petroleum and products moved by rail against 89,196,000 by pipe line (trunk line only).

In 1947 there were 119,298 miles of pipe line belonging to 71 companies re-

Michael Coates stamping casing at Pittsburgh Steel Company.

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porting to the ICC, an increase of 5947 miles over 1945. There are available, however, no figures for the mileage of intrastate lines not reporting to the ICC beyond 1945. This increase represents 1915 additional miles of gathering system, 2047 miles of products lines, and 1985 miles of crude oil trunk line, and a total valuation at December 31, 1947 of $1,225,168,434, an increase over 1945 of $18,264,606. The operating revenue of these 71 companies amounted to $325,-223,884, of which $53,144,549 was net income, a return of 4.34 percent on investment. During this year a total of 2,474,-339,745 barrels was transported over these 71 lines.

All the above figures indicate that pipelining is a sizable business. In 1906 the Hepburn Act proclaimed the pipe lines to be common carriers and thereby subject to federal regulation. This was but the first step in restrictive regulations intended to place pipe lines on a competitive basis with other common carriers. The so-called "Consent Decree" made effective January 1, 1942, and which limited the distribution of earnings to the shipper owners of the pipeline company to 7 percent of its ICC valuation was the final stroke. More about this later, however, before progressing too far I would like to return to the 1945-ton mile and revenue statements to further illustrate the penalties for economical and efficient transportation placed against the pipe lines.

For moving 67,003,259 ton miles of petroleum products the railroads received $480,435,063, or $7.17 per ton mile, while the pipe lines received $294,-708,924 for moving 89,196,000 ton miles, or $3.30 per ton mile. Further, the revenue derived by the railroads for the transportation of petroleum products declined from 10.90 percent of total revenue in 1931 to 6.01 percent in 1941. In 1943 it jumped to 9.79 percent, a ten-year high, but this is understandable due to wartime conditions. In 1945, when postwar pipe line expansion was just getting under way, it fell to 7.32 percent, reflecting, no doubt, the decrease in military demands.

Before discussing the Consent Decree and its application to pipe line economics I would like to digress a little and define economics from my viewpoint. Economics to me means the science of man's making a living and contains the historical development of economic laws and theories as well as the methods and tools given to man with which to make this living.

Production Factors

We were formerly taught that there were five factors in production: land, labor, capital, management and government, and that each was entitled to his own particular share in the proceeds of production. We were taught further that if the system came into unbalance, and that anyone of the factors received more than his share then there would be an eventual leveling out and the system would again be brought into balance. Land might raise his rent; capital his interest; management his profits; labor his wages and government its taxes. Or the reverse might be true and the whole was governed by supply and demand. Increased governmental regulations and the decreasing spread between gross income and operating profit has given rise on the part of management to technological research. The natural sequence to this has been more efficient machinery, the increased use of automatic controls, and the gradual decrease in manpower per unit of production. This applies not only to pipe lines but to all productive enterprises.

It is peculiar to the pipe line industry that certain phases of it, particularly trunk line station operation, lends itself remarkably well to automatic controls and more efficient pumping machinery. Some of the pipe lines are unionized and the union requirements in some localities are such that for each unit in a station a certain number of men must be maintained. It is a short logical step from these and other increased costs to the result that a 300 horsepower engine can be run with one-half the crew of two 150 horsepower units and pump the same amount of oil. Until the last ten years or so the old slow speed internal combustion engine and reciprocating pump, since they were fully depreciated, were making money and pumping oil cheaper than the newer high speed units; however, as the operating cost increased the economics dictated that larger, more efficient units be installed, and that the spread between the operating costs and gross income be increased. The Consent Decree had a great deal to do with the transition and the abandonment of the fallacy that a pipe line was a common carrier entitled to a just profit. As we saw previously, in 1947, the return on an investment of more than $1 billion was only 4.34 percent under the new economic laws. That 4.34 percent was Management's share in the proceeds of production. In the same year all operating expenses amounted to 17.52 percent. Taxes amounted to 4.58 percent, and Labor's share mounted to 8.25 percent of total valuation.

No consideration of pipe line economics can be complete without at least a partial study or explanation of the final judgment, popularly known as the "Consent Decree," and while I do not feel qualified to explain the Consent Decree I shall do my best to set out its provisions and explain what I know of its application. The Consent Decree is that decree entered by the U. S. District Court for the District of Columbia on December 23, 1941, in the case of the U.S.A. vs The Atlantic Refining Company and others, Civil Action No. 14060. In this action the U. S. sought an injunction against the several defendants and a forfeiture of three times the amount of alleged refunds, rebates and effects paid to the shipper owners by the defendant common carriers after January 1, 1935.

Profit Limitation

This action was brought under the terms of the Elkins Act and in it the government attempted to have the court hold that the payment of dividends to shipper owners constitutes a rebate in violation of the terms of the Act. Paragraph 3 of the decree prohibits defendant common carriers from crediting, giving, granting or paying, directly or indirectly, "through or by any means or device whatsoever, to any shipper owner in any calendar year commencing as of January 1, 1942, any earnings, dividends, sums of money or other valuable considerations derived from transportation or other common carrier services which in the aggregate is in excess of its share of 7 percent of the valuation of such common carrier's property, if such common carrier shall have transported during said calendar year any crude oil or gasoline or other petroleum products for said shipper owner."

Paragraph 5 of the Act reads as follows: "Commencing January 1, 1942, each defendant common carrier shall retain (except as hereinafter provided) net earnings derived from transportation or other common carrier services in excess of the amounts permitted to be credited, granted, paid or given by Paragraph 3 hereof, and transfer such excess earnings to the surplus account within 90 days after the end of each calendar year. The said excess earnings shall be transferred to the surplus account as a separate item therein and in such a form as to be readily identifiable."

These excess earnings transferred to surplus account may be used for the acquisition of carrier properties and the income from such properties is in turn restricted and not available for distribution to stockholders. Debts of the defendant carriers to their parent company for construction of carrier facilities in existence prior to January 1, 1942, may be paid from the segregated surplus.

The initial "final" valuation in this judgment refers to the valuation as of

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December 29, 1948

Mr H R Carlson, Ass't Dist Mgr Industrial
International Harvester Company
1809 South Lamar Street
Dallas, Texas

Dear Mr Carlson

As you know we have been using International Power Units for the past six years We now have a total of sixty-one International engines in service, forty-nine of which are being used for oil well pumping purposes

We purchased our first International Power Unit in May, 1942, and this U-4 Power Unit was installed on the Griffin "D" Lease, Well No 3 on June 6, 1942 The depth of this well is 4,368 feet

The purpose of this letter is to tell you about the excellent motor performance we have had from this engine It is on a 24-hour operation, and since being installed, it has operated 56,232 hours, and to date the head or motor pan have never been removed The engine is still operating with the original main and connecting rod bearings, sleeves, pistons and valves The valve tappets were adjusted once during these 6-1/2 years operation We feel this is a splendid record for your engine

We also have a U-6 on the Daume Lease, Well B-1, that has 26,280 hours of operation to date, and the head or pan have never been removed We are hopeful that the balance of our International Power Units will perform as well

You will be interested to know that we are using your U-6 International engine on some new production we have and if our original plans are carried out we will standardize on this engine in that field

We are interested in dependable power and operating at a low cost We believe you have that in your International Power Units and your International Trucks which we also use

You can readily appreciate why we are International Power minded

Very truly yours,
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December 31, 1934, made by the ICC. Under the terms of the Consent Decree it is this valuation plus adjustments to date which is used by most of the pipe line carriers in determining the distributable earnings to shipper owners. I believe at this time two of the pipe line carriers covered by this decree have been working under adjusted valuations based on December 31, 1939, and new valuations as of 1947 or 1948 are projected. The method of determining new final valuations is one which long has been argued by the legal and accounting departments, and until they arrive at some conclusion it cannot be a concern of engineers.

For the record I would not attempt to expertise the application of the Elkins Act and decree to the pipe line companies; however, from my personal experience I know that there is so much interchange of oil between shipper owners and so many parallel pipe lines in existence today that competition itself would tend to keep the rates reasonable. The increased trend of government to regulate instead of govern will probably reflect an effort to augment the control of the activities of pipe line companies and their owners. You have only to read the newspapers the past few weeks and see the attempt on the part of one senator from a northern state to divorce not only pipe lines but barge lines from the oil companies which own their stock and furnish a large volume of the product moved over their systems. I bring in these political aspects and their effect on pipe lines operations because they have a very great bearing on pipe line engineering and economic problems and will, no doubt, have a very strong bearing on the future engineering and economic treatment of all industry.

In terms of economics you can see what this means. By limiting distribution of earnings to 7 percent there is a restriction on incentive to accumulate funds from earnings for replacement of obsolete and wornout equipment. There can be no funds available from unrestricted earnings for the purchase of improved machinery when the old becomes technologically obsolete. The normal depreciation rate based on purchase price in effect 20 or even ten years ago leaves little when you consider today's relatively high prices. Consequently, the pipe line engineer finds himself doing one of two things, either he patches his old lines and squeezes the last drops through between the leak clamps or he borrows capital.

These facts plus the increased demand for petroleum products coupled with the shortage of pipe has hastened the technical advancement in the science of pipe lining. Many of the major pipe line companies have doubled and tripled their engineering staffs in the last five years. And finding that the average engineer was unfamiliar with the operating methods of a pipe line, many have started training programs to familiarize junior engineers with the basic practices of pipelining.

Continental Pipe Line Company has two of these training courses in effect right now, one for technical personnel and one for clerical. Engineering graduates are taken from the campus, presented with pipe wrenches and for six months work in the gang as connection men. Following this assignment they spend two months as district gaugers, one month each as station engineer marine helpers, and district clerks. After this they spend six months working directly under the chief engineer preparing surveys, maps, cost estimates, station and piping designs, etc. They are then ready to take their place as district engineers.

New Equipment

One of the most important developments to ensue from previously mentioned conditions is new equipment. It is interesting to travel from station to station on almost any large pipe line and see the historical development of the pumping unit. On one western line can be found an old single cylinder horizontal oil engine with a fly-wheel 15 feet in diameter driving an old duplex pump. This unit was originally installed in 1912 and moved to its present location in 1928 and will probably run there for ten more years. At the next station down the line is a modern turbo-charged dual-fuel engine driving the latest thing in pipe line pumps; a ten-cylinder reciprocating job putting out 30,000 barrels per day at 1000 pounds per square inch. This unit occupies about one-third the space of the old single cylinder pump unit and puts out three times the oil. That's pipe line progress. It hasn't all been easy, though; these new high-speed units have developed problems all their own. When first installed the vibration was so intense the header welds crystalized and broke away. One pipe line company experimented for two years before getting their units to work satisfactorily. Another company is still trying to work theirs out. But we are making progress. The transition from 85 to 400 revolutions per minute has certainly destroyed our previous concept of how fluid travels in a pipe.

It is reasonably safe to say that the entire field of pipe line engineering has changed in the last ten years. Line sizes have become gradually larger, reflecting increased applications of true hydraulic principles and the work of far-seeing pipe line engineers who have advanced science as a whole through their studies of fluid flow. Here economics has played its part by combining with hydraulics in the determination of optimum pipe sizes. Many factors influence these selections: the potential of the field, area serviced, probable life of the field, payout, and of course always the immediate needs of the refineries for crude. We in our time, have seen the average line size grow from four-inch to 12-inch with 31-inch the largest crude oil line being laid at present. Gathering systems which used to be two-inch are now four- and six-inch with eight- and 12-inch not uncommon. The pipe shortage has had a great deal of influence on pipe sizes in the last three years, resulting in many looped lines which for good engineering practice should have been rebuilt in larger sizes.

But perhaps the greatest change has been in engines and pumps. Some lines, particularly products lines, have gone to electric motors entirely for prime movers. As a pipe line engineer, the economics of electric motors for pipe line services has never been justifiable except in isolated instances since power and demand charges soon eat up the first saving in prime mover cost. However, many pipe lines are now going to electric motors and centrifugal pumps to decrease the amount of capital necessary to install new facilities under the belief that the increased operating cost can more readily be borne since new requirements for capital loans to pipe lines now require that companies indebtedness be repaid before there is any distribution of earnings even up to the 7 percent allowed by the Consent Degree. This, however, is debatable, and there are probably enough single cases to prohibit any general rules. Besides, there are probably too many power company engineers in this group for me to talk down all by myself. My point is merely that only a few years ago electric motors were almost unheard of for trunk pipe lines.

Now the diesel and gas diesel men have come along and have offered us engines with high efficency to run on the crude from our lines and from the field gas usually available at low costs wherever pipe lines run. Engines with efficiencies of up to 40 percent are now on the market at costs, even in the present era of high prices, less than the old heavy gun barrel types. There is even a full diesel on the market now suitable for direct connection to centrifugal pumps without the use of separate set up gears. Interesting also is the large increase in portable, high capacity, skid-mounted units. This is a natural sequel to the looped lines and

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the temporary hookups used everywhere to satisfy the unprecedented demand for crude and products in spite of the pipe shortage.

Most of us remember when the slow speed reciprocating pump, turning from 30 to 80 strokes per minute, was the last word in pumping equipment. These were usually belted to a big steam engine or to one of the old heavy slow speed gas or diesel engines. The centrifugal pump was the next step in the over-all improvement of pipe line pumping equipment and they were usually connected through either belt drives or set up gears to obtain the necessary speeds. The centrifugal pump for some applications was a tremendous improvement over the reciprocating type, particularly for trunk line operation where the volume and pressures were relatively constant. Their greatest disadvantage was the lack of flexibility and they were never completely accepted in the pipe line industry. The development of rural power brought in the electric motor as a prime mover and increased the utilization of centrifugal pumps since they could then be direct connected without belts or gears. This too, had its disadvantages lacking the same flexibility of the internal combustion driven centrifugal pump and also its adaptability to a staggering operation.

The next step was the development of the multi-cylinder reciprocating pump which was adapted for high speeds and direct connection to medium speed prime movers. These pumps started with three-cylinder and ranged up to nine-cylinder and with smaller plungers eliminated a great deal of the inherent mechanical difficulties of the old plunger pump and gave greater operating flexibility than centrifugals. They were, nevertheless, still subject to pressure surges and vibration, however, their place in the historical development is well marked.

To obtain further flexibility and adaptability and to allow the greater use of automatic controls in pipe line pumping stations, the variable stroke pump was developed. This pump was designed to deliver varying quantities of fluid at constant pressures and constant speed. This lent itself to operation by contant speed prime movers and to remote control which again tended to reduce the operating cost of pipe trunk lines operations. The next thing in the pumping equipment field is the multi-cylinder, single acting pump with a very short stroke, which is a further attempt on the part of the pump builders to combine the smooth operation of the centrifugal unit with the flexibility and high efficiency of the piston pump. There is no doubt that there will be a continuing effort on the part of equipment builders to manufacture pumping units with higher efficiency, greater flexibility and increased use of automatic controls to eliminate insofar as possible the human element in station operations. The demand for this type of unit will keep increasing as the effort to maintain the balance between increased labor costs and lower gross profits becomes more noticeable.

More Diesel Power

Since the last war we have seen a new concept in engines as well as pumps. Diesel power is gradually replacing gas in pipe line operation. While it will never completely replace gas in all operations, the price of gas as a fuel has climbed from a low of .05 cents per Mcf to as much as .40 cents in some places where pipe lines operate. This is normal and perhaps the pipe lines themselves are to blame for this increased cost since they have widened the distribution area of gas produced in the southwestern states to include practically the whole country, and the law of supply and demand has backfired on the pipeliners to the extent that what was once thought a cheap and plentiful fuel is getting scarcer and more expensive day by day.

The increased use of diesel fuel and the smaller diesel cuts which are being taken from the crude due to increased refining efficiency and the striving for higher gasoline yields have driven the price of diesel fuel to a point where it is uneconomical to use. However, as long as an oil pipe line pumps oil it has at its command a very cheap source of fuel—the crude oil. While crude can be used for fuel in most low speed diesel engines merely by applying proper filtering practices, the medium and high speed diesels which are coming into greater use for pipe line pumping require narrower limits for their fuel than can be obtained from most crudes. It has proven profitable in some cases to use portable treating plants which have recently been developed to use the waste heat from the engine exhaust to practically refine the crude into usable diesel fuel. The peculiar circumstances which have arisen due to increased crude and products demands and the pipe shortage have increased the demands for portable booster units and have made it profitable even to use high-priced diesel fuel to save the expense of building a permanent station which would have to be dismantled when pipe becomes more plentiful and lines of adequate sizes can be laid. This has had one advantage in that it has shown pipe line operators that the modern high speed diesel is as reliable and more economical than the old heavy, slow-speed unit. Perhaps the greatest job the engine builders have had in the last 10 years was to convince the pipe line operators that the high speed pumping unit is here to stay and to convince them that the old heavy pig iron is no longer necessary for long-lived efficient operation.

I have purposely left the discussion of the gas diesel to the last, since it is the latest development in the pumping picture. There is no doubt that economic circumstances and increased research have raised engine efficiency to the point where any prime mover delivering less than 40 percent thermal efficiency will be out of the pipe line business before too much longer. However, like all new things there are still bugs to be worked out of the gas diesel. Although increasing fuel costs will encourage the pipe line operators to aid the dual-fuel engine builders in their research, the development of the supercharger will also play an important part in the full utilization of the gas diesel. There have been a few accidents with the super-charged gas diesel engines; however, too much importance should not be attached to these, and I believe they will have served to teach the engine builders what not to do with this type of engine.

It is difficult to say that any one single factor is responsible for the increased employment of engineers in the pipe line industry. The need for more efficient operation caused by higher operating costs and lower allowable returns, the increased demand for petroleum products or the pipe shortage, together perhaps account for most of the changed thinking in pipe line economics, but the increased importance of the engineer and the greater dependence of managment on engineering guidance throughout the petroleum industry as a whole is probably now being reflected in pipe line management policies.

You will note that little has been said about gas pipe lines. These are a field unto themselves and would require special treatment. I might note here, however, that from the latest analysis of pipe line mileage figures there are approximately 100,000 more miles of gas pipe lines than oil pipe lines.

In this paper I have tried merely to hit some high spots in pipe line economic and engineering history, but it is my hope that I have made the point strong enough that in pipe line engineering a man hoping ultimately for an executive or managerial position must be more than an engineer; he must be an economist as well, with vision to see economic trends and translate them into good engineering practice.

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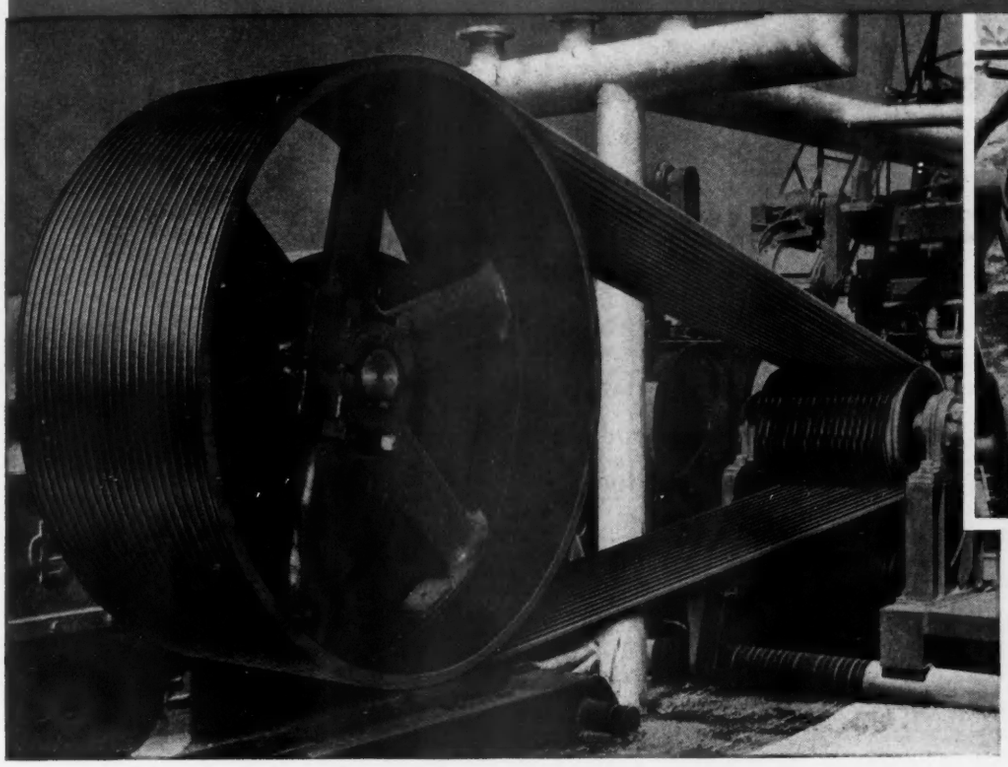

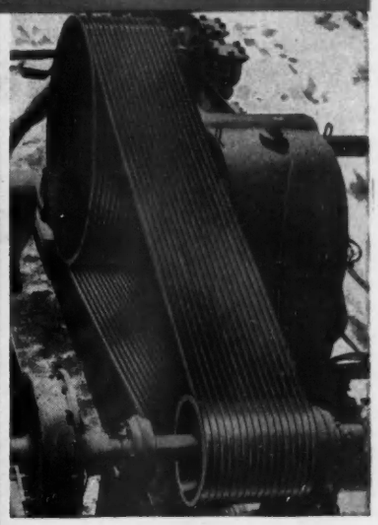

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. . . Clark "Big Angles" on Texas-California Pipe Line

The new Blythe booster station of the Southern California Gas Co. and the Southern Counties Gas Co. is the California link in the big pipe line from the Texas fields to the Los Angeles area. Blythe receives the gas from the El Paso Natural Gas Company, whose nearest booster station is at Gila Bend, Arizona, 140 miles east.

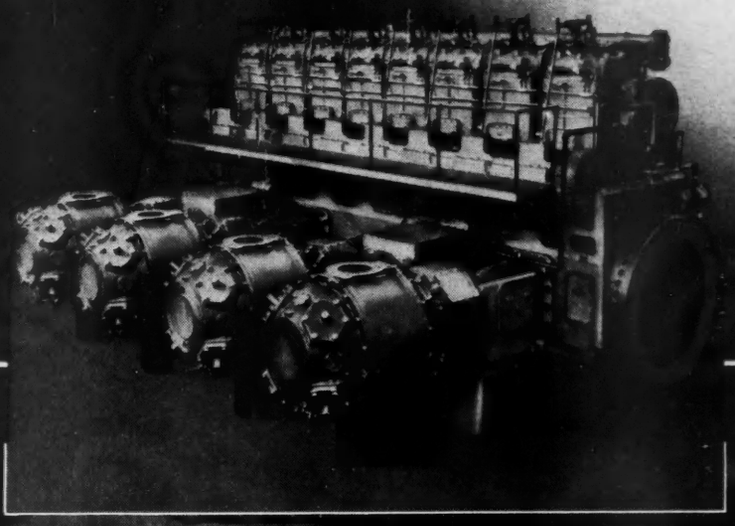
Activation of this new station increases the flow of Texas gas from 175 MMcf per day to the full designed capacity of the station of 305 MMcf per day. That means energy equivalent to the output of six Boulder Dams carried through the largest diameter, high-pressure gas transmission line ever built.

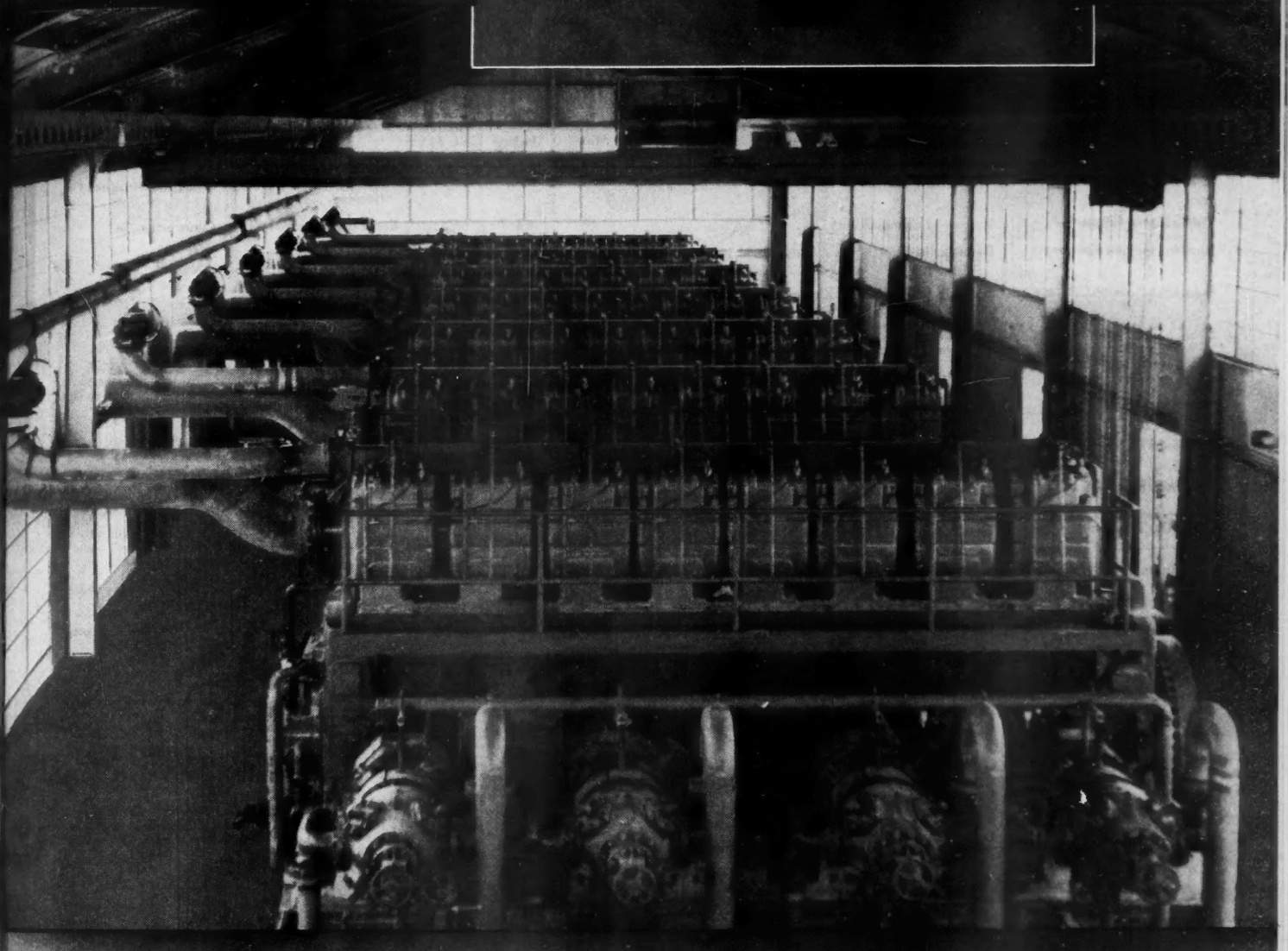
The Clark "Big Angle" installation consists of seven 8-cylinder, 1600 BHP compressor units with a total of 11,200 BHP. The compressors operate with a suction pressure of 350 to 500 psi and a discharge pressure of 680 to 800 psi.

Write for new bulletin on the Clark "Big Angle". It contains detailed information, dimensional drawings and other useful data.

CLARK "BIG ANGLE" COMPRESSORS

e Station





11,200 BHP of Clark "Big Angles" in booster station at Blythe, Calif. (At top) view of 8-cylinder, 1600 BHP Clark Compressor like those in Blythe Station. In addition to being the most compact heavy-duty, gas-engine-driven compressor unit ever built, the Clark "Big Angle" is the most accessible. It saves money in both installation costs and maintenance.

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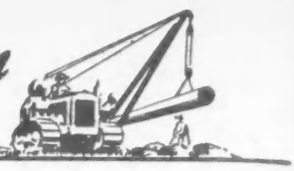
PIPE LINE *Construction*



THE FPC has recently authorized Pacific Gas and Electric Company to construct the largest diameter gas pipe line ever to be built. This project will consist of 506 miles of 34-inch line and will connect the San Francisco Bay area with El Paso Natural Gas Company's proposed 26- and 30-inch gas carrier near Needles on the California-Arizona border.

At the same time El Paso Natural Gas Company received sanction to loop its existing Texas to California carrier and to lay more than 100 miles of new line from Gila, Ariz., to junction with Pacific. G&E. This project will provide a daily market for 250 million cubic feet of Permian Basin gas.

Pipe Line Construction

Tables includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
CRUDE OIL LINES					
T. R. Bryan Associates	Opelousas, Louisiana, vicinity	10	4	.....	Work started in March by Latex Construction Co., Houston.
The California Company	Ruston, Louisiana, vicinity	40	6 & 8	.....	Under Construction by Latex Construction Co.
Humble Pipe Line Company	Gathering facilities in Rita & Sarita Fields, Kenedy County, S. W. Texas	30	4 & 6	.....	Scheduled to start about end of March.
Onyx Oil & Refining Company	Hardy Field, Jones Co., N. Central Tex. to refinery north of Abilene	16	4	.....	Scheduled for early construction.
Stanolind Pipe Line Company	Jones Ranch Field, Gaines-Yoakum Co., to Wasson Field Station, Yoakum Co., West Texas	9	4	.....	Completed early this year.
The Texas-Empire Pipe Line Company	Patoka to Wilmington, Illinois	183	18	69,000	Contracts awarded to Anderson Bros. Corp., Houston for 59 miles from Patoka, and remaining 124 miles to H. C. Price Co., Bartlesville. Work to start in April.
PRODUCTS LINES					
Stanolind Pipe Line Company	Slaughter Casinghead Plant, Hockley Co. to Slaughter Pump Station, West Texas	7⅞o	6	19,000	This natural gasoline and butane line was completed in March by Crosley and Hardy, Levelland, Texas.
NATURAL GAS LINES					
Atlantic Seaboard Corp. & Virginia Gas Transmission Company	Clendenin, W. Va. to Rockville, Maryland	268	26	.....	H. C. Price Co. will lay 200 miles from Rockville and Ray L. Smith & Son, Inc., Eldorado, Kans. will build 68 miles from Clendenin. Both to start in May.
C. L. Brown	Fairfield Field, Freestone County to Mexia Field, Limestone County, East Central Texas	35	4	.....	This line is to supply gas for pumping owner's leases in Mexia Field and is now being constructed.
Colorado-Wyoming Gas Company	Looping of Denver to Cheyenne line	41	..	.....	Federal Power Commission has authorized this project which will increase capacity 15 mln per day.
Dow Chemical Company	Bay City, Texas, vicinity	15	4	.....	Work started in March by Latex Construction Co.
El Paso Natural Gas Company	Eunice, N. Mex. to Blythe, Cal. Loops on main line	247	26 & 30	.....	Recent authorization by FPC will enable El Paso Natural to deliver an additional 250 mln cu. ft. per day to California border. Cost will be about $52½ million and work will start soon.
	Gila, Aris. to Needles, Cal. New line	119	26 & 30	.....	
	Benedum Field, Upton Co., W. Tex. to Company's Keystone Station, Winkler Co. West Tex. New line	95	24	.....	
Northern Natural Gas Company	Washington County, Kansas	9	24	.....	Bids for constructing all lines were taken in March, but contracts not yet awarded. Most of 24-inch pipe is on the ground and 20-inch is scheduled for 3rd Quarter, 1949.
	Cass County, Nebraska	30	24	.....	
	Cass County, Iowa	18	24	.....	
	Wright County, Iowa	22	24	.....	
	Steele County, Minnesota	26	24	.....	
	Dakota County, Minnesota	12	24	.....	
	Saunders County, Nebraska	21	20	.....	
	Garden City, Kansas, Area	36	16 & 24	.....	
Pacific Gas & Electric Company	El Paso Natural's line at Needles, Cal. to Company's Milpitas, California, Terminal	506	34	150 mln	This line will tie into El Paso's Gila to Needles proposed line. This is the largest diameter for natural gas ever authorized by FPC. Cost will be about $55½ million. Compressors will total 16,800 hp and capacity can be increased to 400 mln by additional power.
Panhandle Eastern Pipe Line Company	Six loops in Kansas on Texas-Michigan line	74½	26 & 30	.....	Contract awarded to R. H. Fulton & Co., Lubbock, Texas.
The Peoples Natural Gas Company	TETCO line, Somerset, Pa. to Company's facilities northeast of Johnstown, Pa.	38	14	.....	Contract not let. Scheduled to start July 1st.
Phillips Petroleum Company	Sherman Field, Texas Panhandle, gathering system	96	8 to 24	.....	Completed in March by Vaughn and Taylor Const. Co., Inc., Wichita Falls.
Texas Eastern Transmission Corp.	"Big & Little Inch" feeder lines in Texas and Louisiana	75	....	.....	FPC authorization also included 86,150 hp addition. Capacity will be increased 75 mln.
Texas Gas Transmission Corp.	TETCO "Big Inch" line to Mitchell, Indiana	7½	8	5 mln	FPC authority granted. This line will enable Texas Gas to fulfill supply contract with Indiana Gas & Water Co. with gas from Texas Eastern's "Big Inch."
	Texas to Ohio line. Spread #10	80	26	.....	Part of proposed 840-mile Texas to Ohio gas line, which has not yet been FPC-authorized. Midwestern Constructors, Inc., Tulsa, has contract for this 80-mile spread if approval is received.
United States Atomic Energy Commission	Existing line 35 miles south of Bloomfield, N. Mex. to Los Alamos, N. Mex.	95	12	.....	Bids to be taken in April. Work to start 10 days after award.

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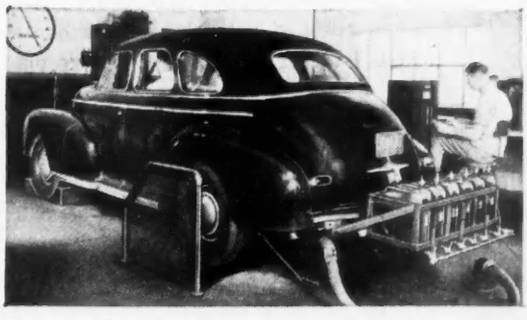

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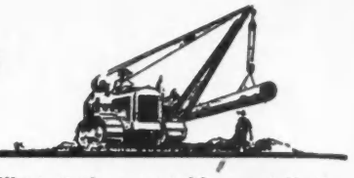
How to do it!

PIPE LINE HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Make Bends in Large Diameter Pipe in the Field

While bends in large diameter pipe are normally made in the field by pipe bending machines, there are occasions on short runs where a bending machine is not available, or where the purchase or rental on small jobs is not feasible. On one such occasion it was necessary to bend a 26-inch-diameter pipe in the field without the aid of a pipe bending machine.

The illustration shows how the bend was made, even though the operation requires more time than is ordinarily consumed by a machine. A heater was welded to conform to the pipe being bent, and an area over which the bend was to be made was heated. The bend was about 20 degrees.

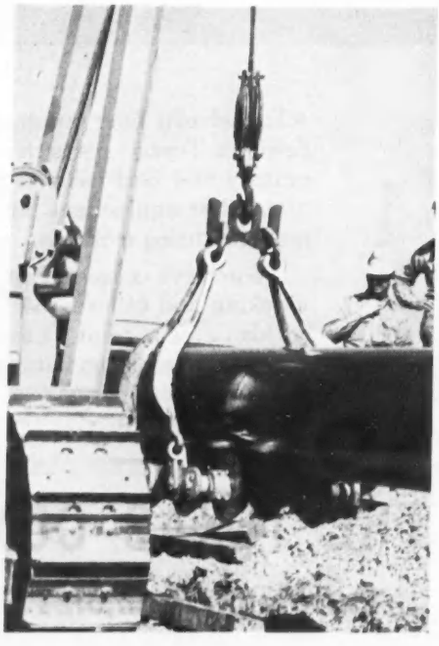
A hole in one end of the heater accepted the burner of a gas torch that threw a hot flame over the area to be heated. A short bracing member was made from the same diameter pipe and cut to conform to the curvature of both pipes. This bracing piece was placed almost perpendicular to the two lines. One joint of pipe served as the rigid section and was not bent. Both large pipes were bound together at one end by steel cables as shown. To the opposite end of the rigid section was mounted a hand winch. A pulley system was rigged to a sling placed around the far end of the joint to be bent.

By heating an area at the bend it was possible to bend the joint of pipe by taking a strain on the winch line. As the heated area reached a red heat, the line would bend.

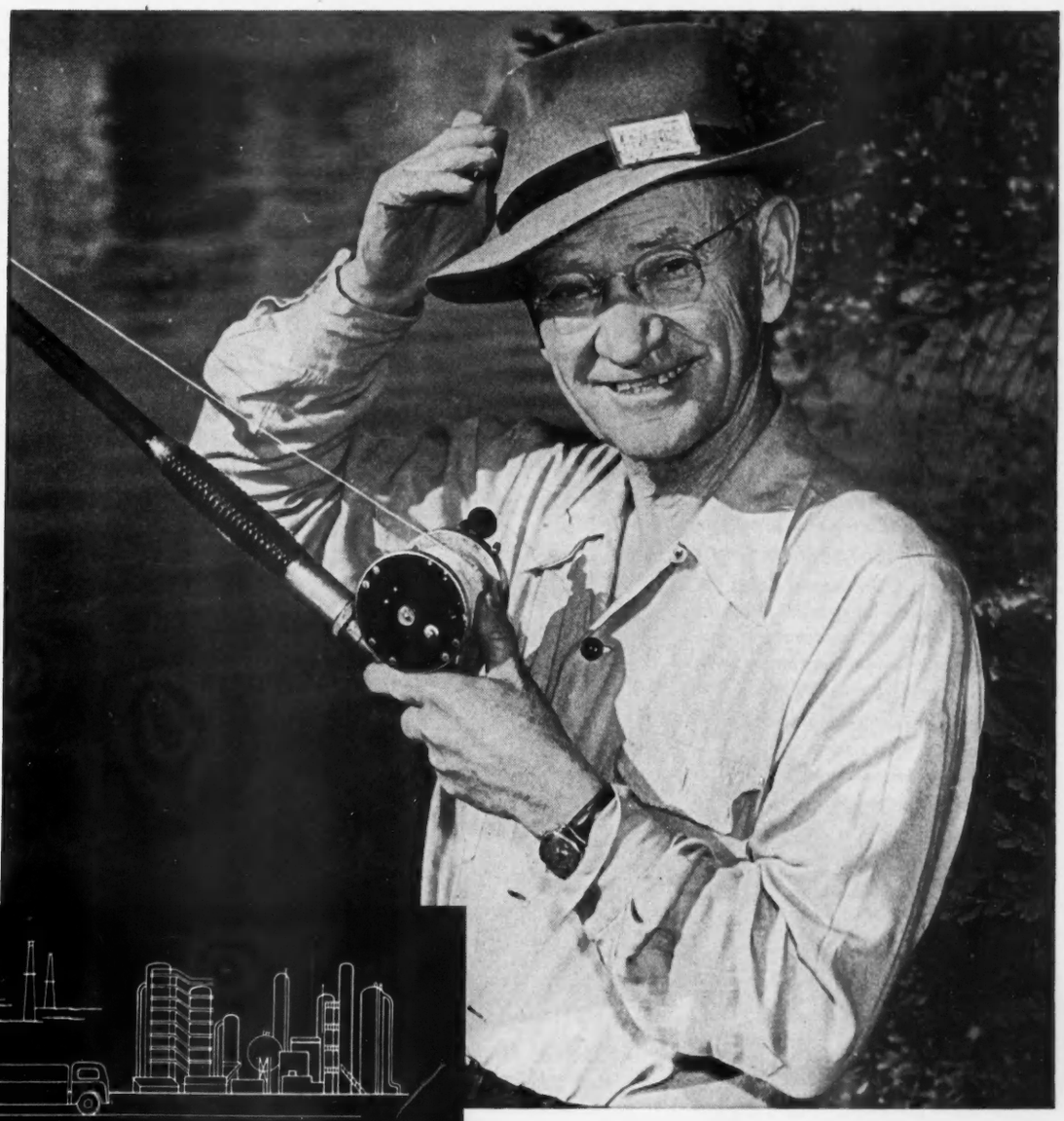
HOW TO—Strengthen Links of Dolly Used to Support Pipe

After the line has been welded together, the process of cleaning, coating and wrapping follows. Cats rigged with side booms lead and follow the coating and wrapping equipment, and support the line over the ditch. This combined operation is a continuous one which requires that the tractors move slowly down the pipe line. As the operation is completed, the line falls back into the ditch and is then ready to be covered up.

Much attention has been given the method of supporting the pipe by tractors so that the operation may proceed along the line rather than work in sections. Pipe dollies equipped with truncated cone shaped rollers support the pipe at each tractor. The illustration shows such a pipe dolly moving down the line ahead of the coating machine.



Provision is made in the pipe dolly for adjustments of varying line sizes by lengthening or shortening the axle. Ordinarily, the large rings in the loops at the end of the supporting links are placed in the hook of a block and the line is lifted. However, in large diameter pipe lines, a spreader was necessary to prevent the links from rubbing the sides of the pipe. A double-prong hook with an eye in the center was cut from one-half-inch plate steel as shown to serve as a spreader, thereby giving more width through the links. Additional space was provided by bending the links outwardly. To prevent the links from straightening under heavy loads when lifting the line, a vertical fin of half-inch plate steel was welded across the bent section as illustrated. The fin conformed to the bend and when welded to the link prevented it from straightening under extreme loads.



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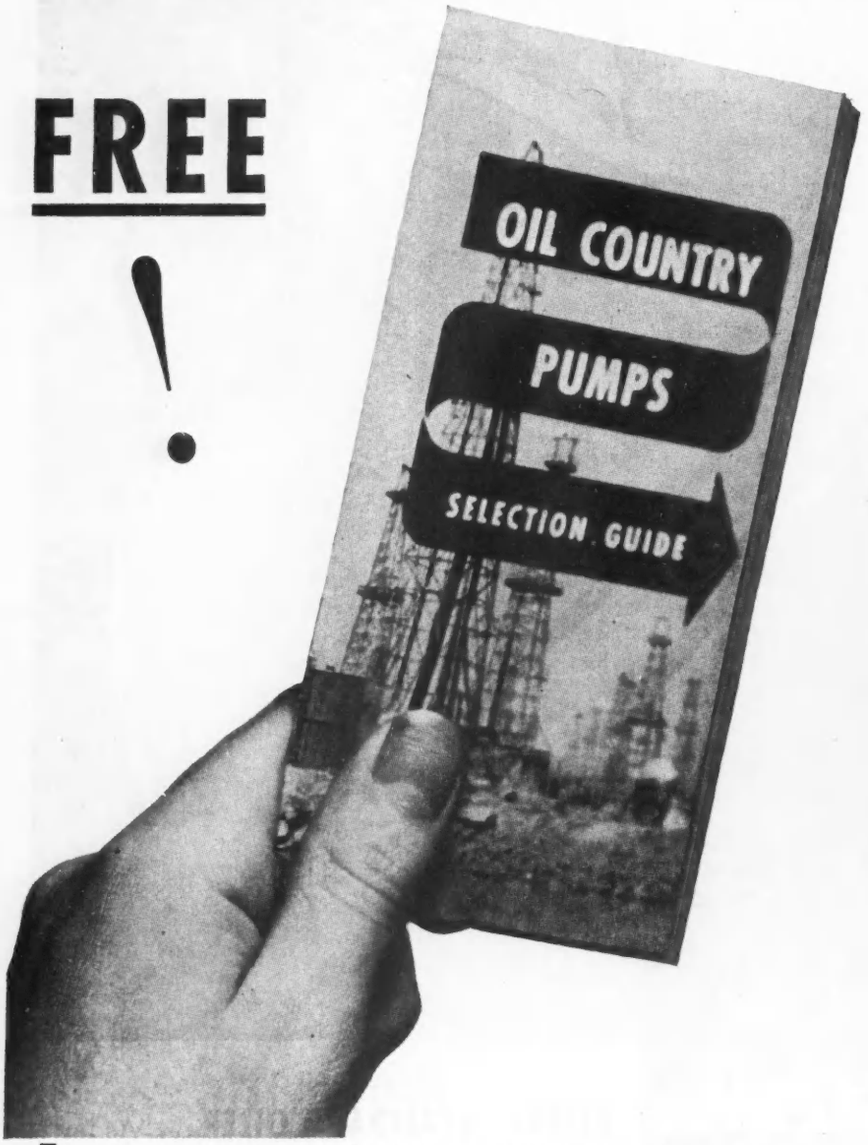
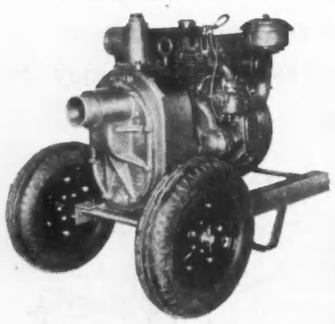


This 24-page booklet contains important information about pumps and pumping in the oil industry. It makes it easy for you to select the right type of pump for various jobs in drilling, production, pipeline and other work. To help you determine the proper size there's a typical oil country pumping problem worked out in detail. Useful tables of friction in pipes, hose and fittings are shown for convenient reference. Other data include valuable operating hints for best pump performance—and more.



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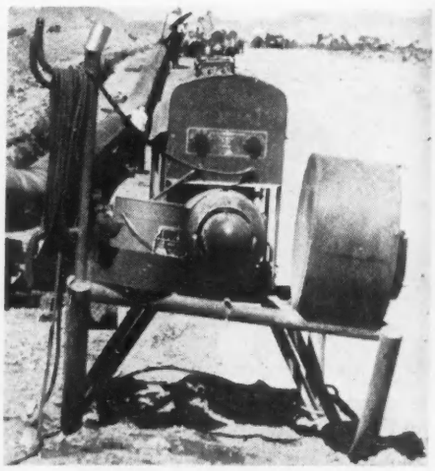
PIPE LINE HINTS

HOW TO—

Mount Welding Units

On long lines where the joints are being electrically welded, contractors have mounted their electrical welding equipment on skids, dollies or sleds. This type of mounting eliminates the need for a truck for each welding unit, thereby saving considerable cost.

Illustrated is such a skid-mounted electric welding machine. With several



of these welders on a line, one vehicle can handle moving all of them by driving up and down the line and moving each one as a weld is completed.

The skid on which this particular unit has been mounted was made from three-inch pipe. The unit is supported about 20 inches off ground so that it can be dragged over rough surface. The runners are bent at each end so the unit can be moved in either direction. It is cross-braced and the engine-driven generator is mounted on this framework.

Provisions have been made at one end of the skid for a water can and a frame on which the electrical cables can be wrapped during moves along the line. This frame is simply two upright pieces of pipe welded to the skid. Each upright has curved arms to accept the cables.

During moves from one job to another where the unit will be exposed to weather and left unguarded, an enclosed cylinder made from a section of 26-inch pipe was added. The container was welded to the skid as shown, and equipped with a door that could be locked. During job moves, the electric cables and associated equipment are locked in the container until the unit arrived at the next job. In this manner, the equipment was protected from the weather and from possible theft.

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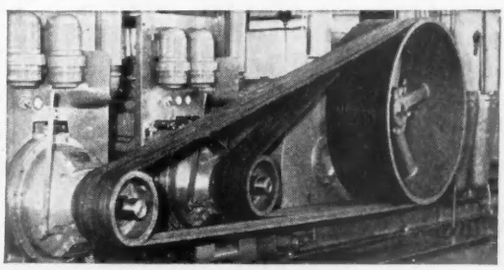

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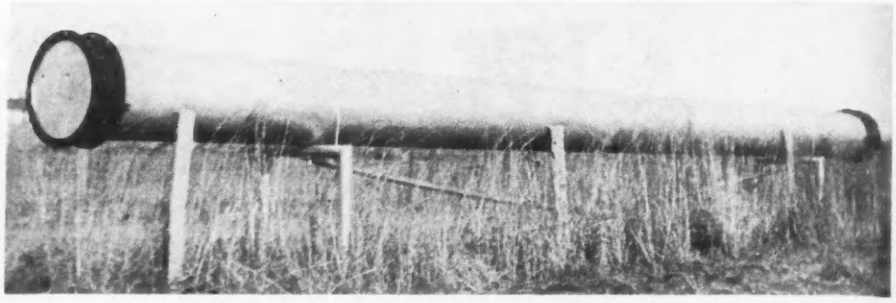
HOW TO—Mount and Protect Emergency Pipe



By placing joints of emergency pipe at points easily accessible for loading with truck and trailer along the course of the pipe line, the necessity of long trips to a pipe storage yard for repair or replacement pipe can be avoided.

To make loading of the emergency pipe as easy as possible, an elevated supporting frame was made from scrap two-inch pipe. The end frames which support the weight of the pipe are set in concrete. Diagonal brace members made from pieces of one-inch pipe add rigidity and help to hold the supporting frames in an upright position.

U-bolts made from one-half-inch round rod hold the joint of emergency pipe on the supporting rack. These can be easily removed either by unscrewing the nuts, or by merely cutting the U-bolts with a torch if the need for time saving is urgent.

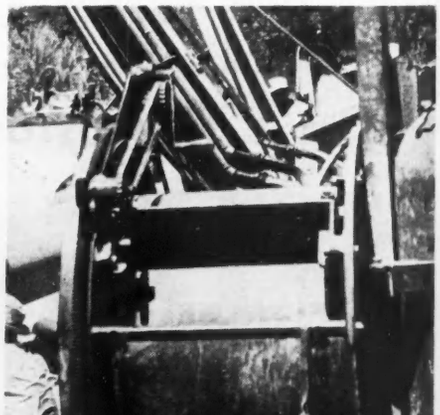
For keeping foreign material, animals, birds, etc., out of the pipe, covers were made from the ends of a discarded oil barrel, cut and trimmed to the proper diameter. Each of these end disks is held in place by a sleeve-type coupling.

HOW TO—Carry Bulky Pipe Beveling Machine

Beveling machines for large diameter pipe, such as 26-inch line pipe, are bulky and quite heavy. Two men are required to place them over the ends of pipe to be beveled. Being a somewhat delicate piece of equipment in pipe line construction work, they require special treatment in handling.

When moving such beveling machines up and down the line, considerable damage will result if care is not exercised in handling it. Illustrated is one idea that has proven valuable in performing this job at the saving of much back strain and possible damage to the beveling machine.

The machine is mounted on a carrier just as it would be strapped to a line preparatory to cutting a bevel. The carrier is a short piece of pipe the same diameter for which the beveling machine is designed, and is just long enough to accommodate the machine. A large piece of plate steel has been welded to one end of this joint and this plate bolted to the side of a truck or tractor. In the case illustrated, the machine has been mounted on the carrier just above the tracks on a tractor, thereby occupying unused space. In loading, two men can stand on the tracks and position the beveling machine on the carrier.



HOW TO—
Drain Meter Moisture

When the gas in a field meter passes through the orifice plate, the rate of flow is diminished on the upstream side of the meter, and liquids are likely to collect between the orifice flange and the gate valve on the upstream side.

This liquid will then surge through the orifice when the rate of flow increases, causing an erratic fluctuation of the differential pen on the recorder.

A connection several inches upstream from the orifice flange will effectively drain the line and prevent liquids from entering the orifice. The connection shown has a plug valve and union on a one-half-inch line which leads to a short piece of six-inch pipe which was capped on both ends, and a quarter-inch outlet placed on the bottom.

In operation, the half-inch plug valve is allowed to remain open and the quarter-inch outlet valve closed. When the meter man picks the chart, he opens the quarter-inch valve and blows off the liquid before it has a chance to collect in the meter run.

HOW TO—
Counterbalance Boom

Side boom tractors used to support the pipe line above ground for various operations are normally equipped with counterbalancing weights. There are occasions when a long lift must be made, necessitating that the side boom be lowered to a 45-degree angle, or less, with the ground. These long lifts require

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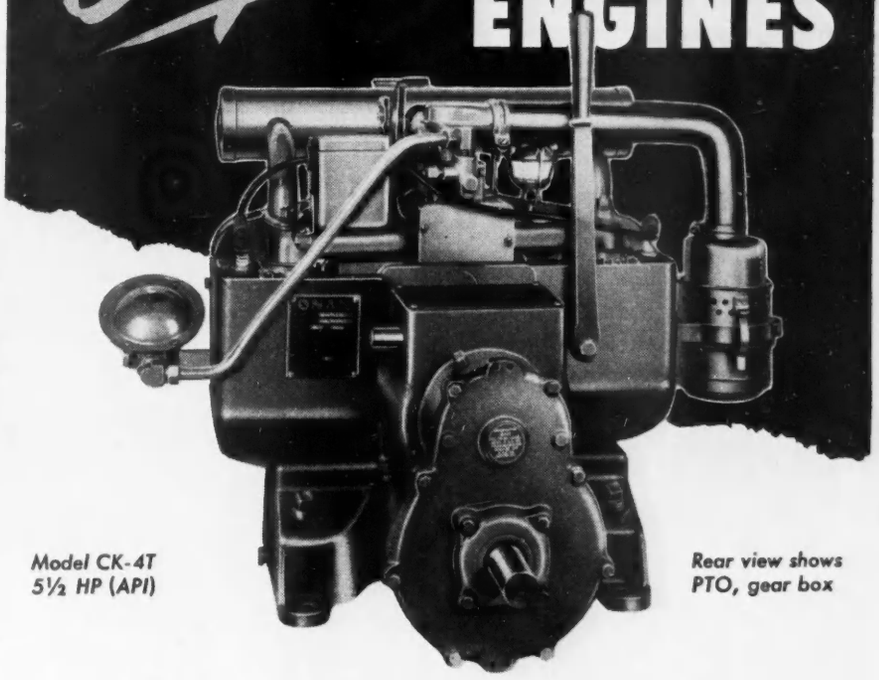

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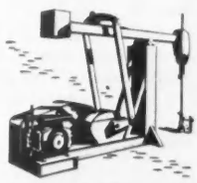

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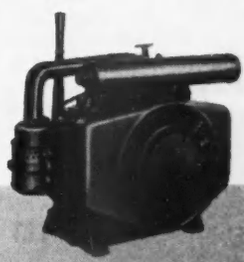

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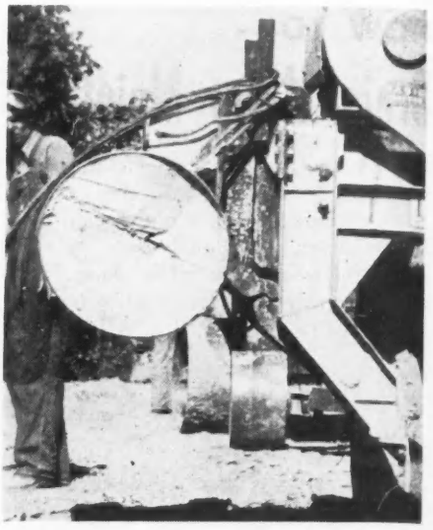
Onan PRODUCTS ENGINES & ELECTRIC PLANTS

additional counterweighting to prevent the tractor from tipping over.

To meet such emergencies, one pipe line contractor made up extra counterbalancing weights in the field. The added weight consisted of a barrel of hardened cement, which added about 650 pounds of additional weight to the side of the tractor. The barrel is first equipped with three heavy plate steel lugs welded to the side. Two of the lugs are welded in line at either end of the barrel, while the third is welded near the center of the barrel and about 14 inches away from the center line of the other two.

The hardened barrel of cement is shown suspended from the side boom cat by short pieces of wire line. The line is threaded through one end, over a short vertical support on the side boom frame, through an eye welded to the drum near its center, then back to a second supporting upright on the tractor and finally to the other lug welded to the opposite end of the barrel.



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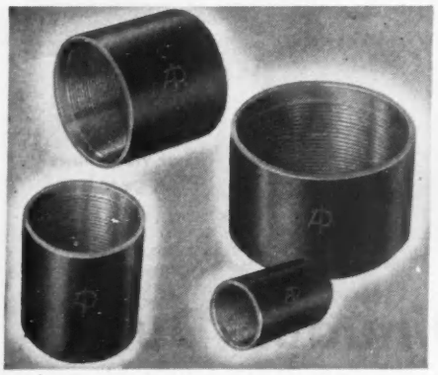

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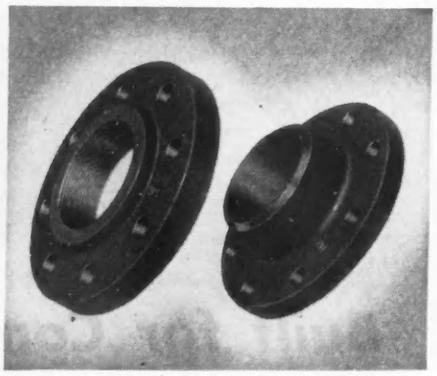

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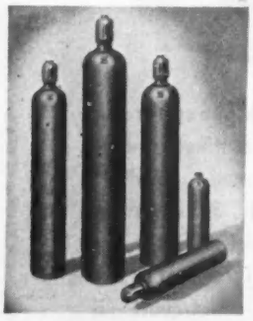

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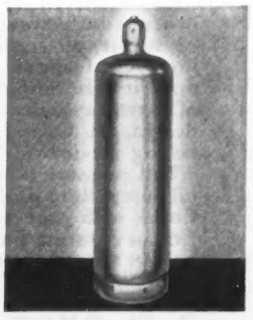

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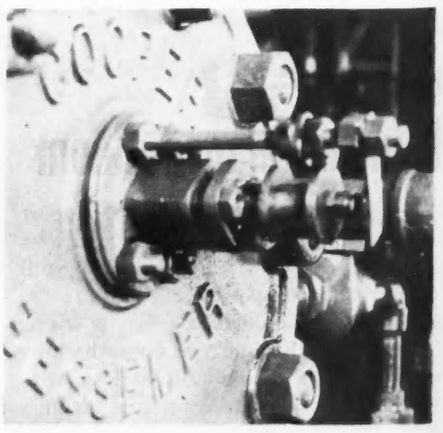
HOW TO—

Adjust Intake Valve

Operation of gas engines designed for fuel injection can be simplified and the adjustment for valve travel can be made with precision by using a device similar to the one being used in a plant where these fixtures were developed. A metal spool is locked on the stem of the inlet valve with lock nuts to prevent the spool from moving. A bolt with threads on each end longer than the valve stem is threaded in the hole of one of the stud bolts taken from the stuffing box flange. A lock nut holds the bolt tightly in place.

The opposite end of the bolt is cut with a long thread to hold a double pair of lock nuts which hold in place a knife-blade plate set between the flanges of the spool to adjust for valve travel. With the engine running, the fuel mixture can be changed by loosening one of the lock nuts so the knife-blade can be run up against the spool flange, or slacked off



New Oil Law Restricts Egyptian Operations

By GEORGE O. IVES
International Editor

Setting up rig for wildcat in Egyptian desert.

THE new Mines and Quarries Law under which Egypt's oil industry is to be operated is strongly indicative of the increasingly nationalistic attitude of the authorities, and there has arisen some question in the minds of operators as to whether foreign capital can participate in the nation's oil development on an economically feasible basis. The decision of the government, as to just how certain problems are to be solved under the new law and subsequent regulations could have an extremely important bearing on its future development.

Already one of the major operators with world-wide interests has announced its decision to discontinue all operations in Egypt until the situation is clarified. Standard Oil Company of Egypt, a subsidiary of Standard Oil Company (N.J.) announced such a decision a few weeks ago, giving as one of the principal objections to the new regulations the provisions dealing with export of crude. Other provisions are also regarded as too restrictive to allow efficient operation, and it is generally believed that enforcement of Egypt's new petroleum policy is ill-timed in view of the current world market situation which finds crude oil in abundant supply from other sources, whereas any additional producing potential built up in Egypt would be restricted to the capacity of refineries within the country itself and controlled by the government. Thus increased supplies of crude in Egypt must remain in the country and see possible markets filled by crude from nations without such restrictive legislation.

12 Years of Work

The Standard company made its decision to suspend Egyptian operations shortly after having discovered a new oil field, its first discovery in more than 12 years of preliminary work and exploratory drilling in Egypt, and representing an expenditure of more than $12½ million. While the magnitude of the discovery is not too well known from the rather meager information furnished by the completion of one well, it has itself been estimated as capable of producing at rates as high as 3000 barrels daily. Other less optimistic reports set the well's capacity at nearer 150 barrels a day. The new field is known as Wadi Feran, about 155 miles south of Suez on the Sinai Peninsula within a short distance of the Gulf of Suez, within relatively easy access of marine transportation.

Although production from the Ras Gharib field, long the principal source of Egyptian crude, has been kept up only at the expense of careful producing methods, with decline inevitable within a short time, and the Hurghada field has continued its decline, the production from Sudr has been sufficient to raise total output for 1948 to a new all-time high of more than 13 million barrels. Table 1 is a comparison of production from Egyptian fields in 1947 and 1948:

Meanwhile, events of recent months have revived interest in the long-range possibilities of Egypt as a possible major contributor to world crude supplies. There were two discoveries on the Sinai Peninsula during the past year, and recently an outpost in the Asl area electrified the industry with the early reports that it was being tested at a flowing rate of 38,000 barrels a day. Later clarification of these reports indicated that while the well did, in fact, produce on short tests at the time of completion at rates of 27 barrels per

TABLE 1

	PRODUCTION IN BARRELS			
	1947		1948	
	Total	Daily	Total	Daily
Ras Gharib	8,847,000	24,200	9,295,000	25,400
Hurghada	351,000	1,000	345,000	900
Sudr	118,000	300	3,494,000	9,500
	9,316,000	25,500	13,134,000	35,800

minute, it was estimated that on steady production it would probably settle down to about 3500 barrels a day through open tubing, and when tested through a 7/16-inch choke it flowed at the rate of 1615 barrels daily. Such a rate is on the order of the better wells completed thus far in the Sudr and Asl fields, several of which have proved themselves capable of producing more than 5000 barrels daily.

The production at Asl is mostly from Eocene Limestone beneath a Miocene unconformity, and therefore similar to that at Sudr, about ten miles north, which went on production slightly more than a year ago. Production is found from 3300 to 3900 feet. The discovery itself was completed at 3910 feet making 3000 barrels of 22-gravity oil daily through open tubing. The field is on acreage held jointly by Anglo-Egyptian Oilfields, Ltd. (Shell Group) and Socony-Vacuum Oil Company. The same companies also own jointly the area which includes the Sudr field and the recently discovered Ras Matarma field between Asl and Sudr.

Ras Matarma is still an unknown quantity, since only two wells have been drilled. It produces from a sand in the Miocene which apparently corresponds to a sand tested in one of the wells in the Asl field. Oil is 18 gravity, somewhat heavier than the new production from Asl and Sudr.

Thus far Sudr is the only field actually on production, it being connected to a terminal on the Gulf of Suez by a six-inch pipe line about 11 miles long. A line is now under construction to connect Sudr and Asl, and there has been some discussion of a line from the Sudr-Asl area to the vicinity of Port Said on the Mediterranean to bypass the Suez Canal. However, rigid enforcement of Egypt's new policy would preclude the consummation of such a project since, except in extreme cases, with special dispensation by the authorities, all exports from the nation would have to be in the form of products refined within the nation. The powerful Egyptian Saadist party has recently declared itself in favor of an oil policy prohibiting exports other than in the form of refined products processed in Egyptian plants only, and the government has already refused request of the Shell Group to expand its Suez refinery to take care of more throughput, unless the company is prepared to give the government a 51 percent share in the refinery.

Under the circumstances it seems that although the productive capacity of Egypt has increased sharply in recent months, it is likely that production will remain bottlenecked by the lack of refinery capacity. At the beginning of this year production was running something more than 42,000 barrels daily, which is more than 100 percent rated capacity of the Shell Group plant plus that of the government's small installation.

Following are the main provisions of the Mines and Quarries Law:

1. Prospecting licenses are to be rectangular in shape with no side less than five kilometers in length, and with area not exceeding 100 square kilometers (25,000 acres).
2. The prospecting licenses are to be granted for a term of one year, renewable annually as long as exploration work "is executed in a serious manner." Renewal of the licenses beyond the fourth year is dependent on whether drilling operations are carried on continuously.
3. Rentals are set at ten Egyptian pounds ($40) per square kilometer for the first year, 100 pounds for the second year, and 25 pounds for each subsequent year.
4. On conversion of prospecting licenses to mining leases, the holder is entitled to retain half of the area covered by the prospecting license at 15 percent royalty. The lease is to be rectangular in shape with sides parallel to the boundaries of the original prospecting license. The leases are to be granted only to those companies which have been formed in accordance with the Egyptian Companies Law, and term of the lease is to be for a period of 30 years, renewable for an additional 15-year period with the royalty upon renewal being stepped up to 25 percent.
5. The lessee is entitled, after having obtained a lease of one-half the area covered by the prospecting license, to lease any part of the remaining area at a stipulated royalty of 25 percent.
6. The government retains the right on all leases to purchase up to 20 percent of crude produced or products obtained, at a rate of 10 percent less than world market prices.

Complete Supervision

The Ministry of Mines and Quarries is the government agency which will regulate the nation's petroleum industry, and will maintain complete supervision of all operations. The new lease contract provides for such complete supervision on the part of the ministry that the company is left small latitude for operating its properties. The company must obtain the approval of the agency for many field operations normally considered to be routine.

Since the passage of the new law a number of applications have been made for prospecting licenses, most of which have been in the vicinity of the known producing areas around the Gulf of Suez. However, no actual licenses had been granted under law at the time of latest report, although some leases which had been applied for before the effective date of the new law had been validated.

Under an operating agreement, Anglo-Egyptian Oil Company (Shell Group) and Socony-Vacuum Oil Company share jointly in prospecting and development work on licenses in the Sinai region. According to the new Mines and Quarries regulations, leases once taken by any company are not transferrable. One company's interest in a lease cannot be transferred to another company.

There have been a number of proposals for expansion of the nation's refinery capacity. In addition to proposals for increasing capacity of the Shell Group refinery, new construction is planned for the government plant which has a rated capacity of only 1800 barrels, and which may be increased to double that amount. The government has also discussed plans for building a plant capable of handling 20,000 barrels of crude daily.

The Ministry of Commerce and Industry is considering a report drawn up by a special committee which recommends the establishment of a new refinery in Egypt in cooperation with American companies operating in Saudi Arabia, and advocating a pipe line to Suez or some other Egyptian port. The committee suggests that the American companies should undertake to supply such a proposed refinery with oil for a period of 25 years at the market price, in addition to such oil as is drawn from local sources; and that the Egyptian company should be entitled to distribute refined products to retail dealers in Egypt with the understanding that products in excess of local needs can be exported by the distributing company. It has also been suggested that oil refined locally could enjoy a protective tariff.

In this connection it has been pointed out that oil from the Sinai fields contains on the average a relatively small percentage of light oil, insufficient for Egypt's domestic requirements, while the balance of heavy products is more than sufficient. Consequently, it seems that although production from local sources should reach a rate within a few months which would be sufficient in volume to take care of Egypt's 17½-million-barrel annual consumption, there must be imports of some light oils and exports of the excess heavier oil. In view of this it is now thought that a refinery site on the Mediterranean coast would be more feasible since the only markets for Egyptian oil would lie to the west.

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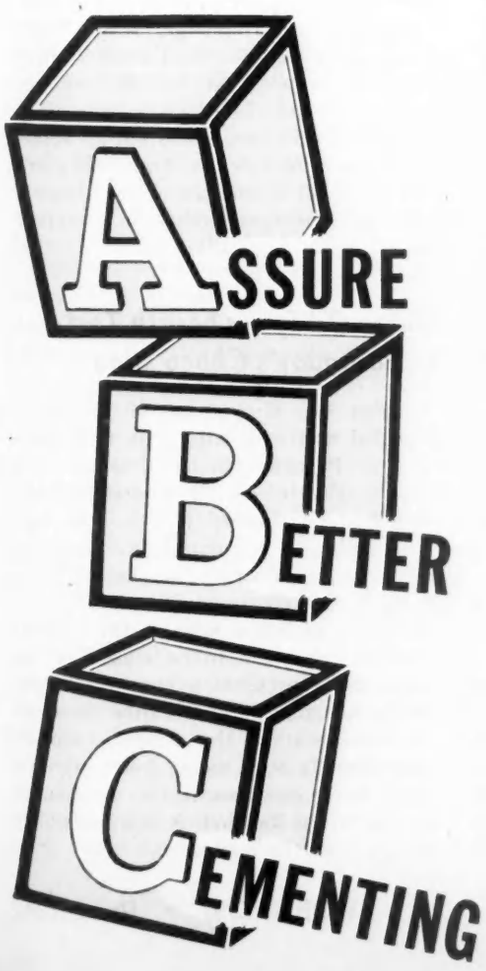

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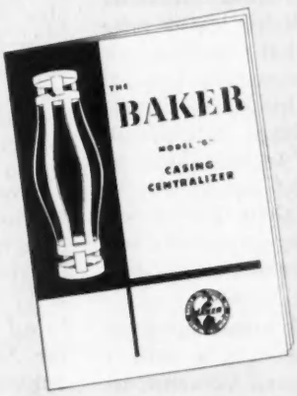

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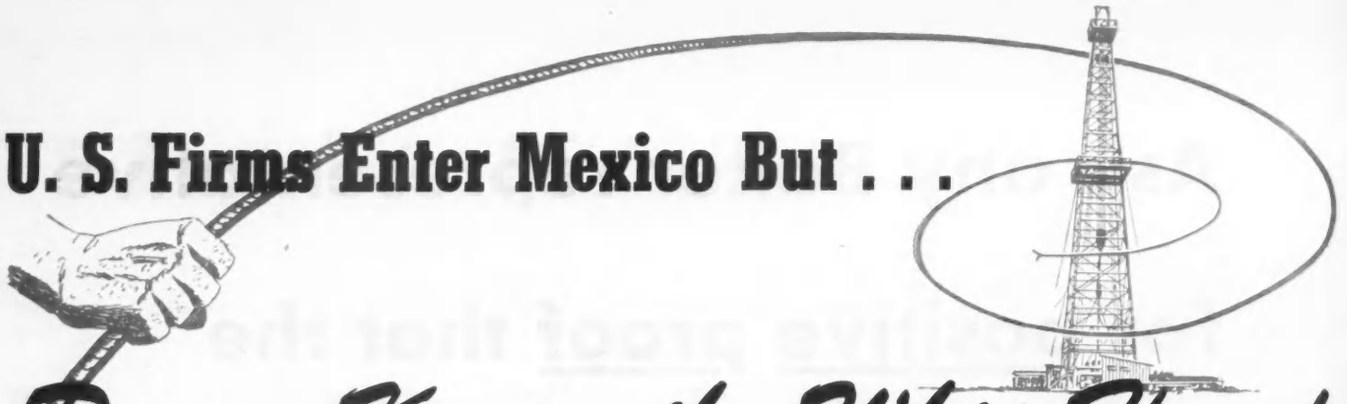


U. S. Firms Enter Mexico But . . .

Pemex Keeps the Whip Hand

By HENRY OZANNE
Staff Writer

THE agreement signed between Mexico and three American oil operators shows that Mexico still will not offer more than a drilling contract to entice foreign capital and skills south of the border, and the last hope was killed that Mexico's petroleum legislation might be liberalized to permit U.S. oil companies back in Mexico on some kind of concession basis.

This was made clear by Senator Antonio Bermudez, director of Pemex, the Mexican state oil monopoly, who declared on his recent trip to Washington that all future negotiations with American oil firms "will have to be exactly along the same lines" as the deal just effected with the Mexican American Independent Company. This contract was signed in Mexico City in early March between Pemex on one hand and American Independent Oil Company, Signal Oil and Gas Company, and Edwin W. Pauley on the other. American Independent is headed by Ralph Davies, who lately negotiated for that company concession rights in the neutral zone of Kuwait. Signal Oil is headed by Samuel B. Mosher, while Pauley is an independent producer of Los Angeles. Mexican American Independent Company will be the operating setup of these three American interests which remain entirely separate except for their joint operating program in Mexico.

Pemex terms to the American operators include a 25-year right to drill in the states of Tabasco and Veracruz, together with offshore submerged lands, including some locations staked out for Pemex by American geologists and geophysicists. Pemex is to earmark 50 percent of production obtained by Mexican American Independent to pay expenses incurred in finding the new oil, and 15 percent of the value of the total new production is to go to the American company as "profit and compensation for risks assumed." This amount steps up to 16 percent from sheltered waters and up to 18½ percent on all-water locations. The American operating group will stand all dry hole expenses, unless and until it discovers oil, whereupon the company can recover all previous costs out of the 50 percent production arrangement. That is, if the operators drill ten dry holes and quit, they bear all expenses. But if they drill ten dry holes and then find oil, they can recover the expense of all 11 wells out of 50 percent of the latter well's production. All wells must be drilled in the first 12 years of the contract, and at first this provision was not clarified in relation to the full 25-year life of the contract. The American operators can take their expense and profit in oil providing Pemex judges Mexico has a sufficient exportable surplus of oil; otherwise the operators are to be paid in cash, with oil prices based on the average value of comparable Texas crudes at Texas Gulf ports.

Issues Unsettled

Several long-standing issues between Mexico and American oil companies have not been settled by the terms. For instance, Pemex assumes control of every well brought in, and exercises broad over-all supervision in directing the American operators where to drill, although location of structures, it is understood, will actually depend largely on the operators' advice.

Although the contractors hailed the agreement as opening the way "for activities of profound importance to both the U.S. and Mexico," the major sector of the American petroleum industry tended to regard the agreement as basically unattractive. Bermudez at a Washington press conference did not mince words that he believed Pemex was retaining the whip hand in the new program. He said: "American capital may come into Mexico when it accepts the conditions imposed by our laws. There is not the slightest chance of changing the law regarding sub-soil rights. Americans, like all foreigners, can contract with us for exploration and drilling—as in the case of the contracts just entered into — but exploitation must remain in the hands of the Mexican government."

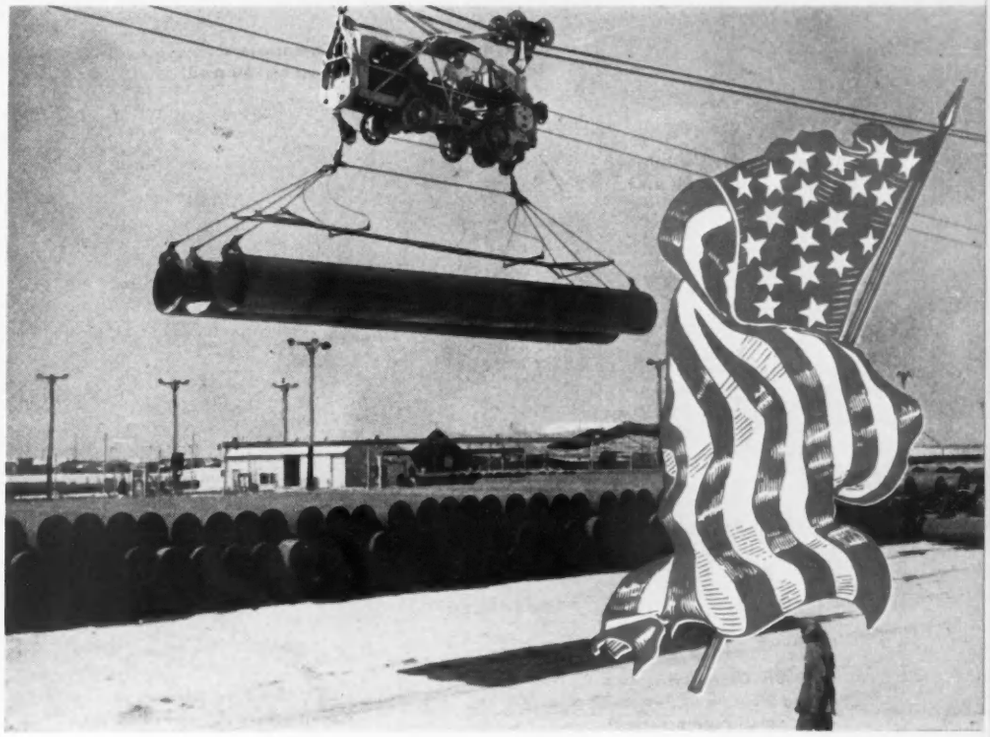
During his visit in Washington, Bermudez consulted with the Export-Import Bank and various agency officials, presumably in search of a loan by which the oil program could be expedited. Pemex already has requested a $470 million U.S. loan for this purpose. Bermudez also conferred in Washington with Gordon Street of The Wheland Company of Chattanooga, Tenn. Wheland has on file with the Export-Import Bank an application for $10 million credit to Pemex for the purchase of 25 drilling rigs. Pemex would put up bonds for the amount, amortized over ten years or paid in oil at the rate of 5000 barrels a day from current production at market price.

Union Oil Spuds Fourth Test In Paraguay's Chaco Area

Union Oil Company of California spudded its fourth wildcat in the Chaco area of Paraguay in the first week of March. The third well, Pirizal 1, abandoned approximately two months ago, was drilled to a total depth of 10,331 feet without important shows.

The new well, approximately 70 miles due north of Santa Rosa, is the farthest north location yet to be staked in the area, and represents a stepout of considerable magnitude. Location is about 35 miles east of the Bolivian border. Considerable road work, frequently delayed by heavy rains, had to be done in getting to the location. A camp has been set up near the well site.

Tapline Steel License Raises New Issues



Does granting of steel to the Tapline in effect hoist the U. S. flag over the line?

COMMERCE Department's approval of the long-withheld export license for steel for the trans-Arabian pipe line has raised new issues and questions in both industry and government circles. Commerce Department Secretary Sawyer announced February 24 that Trans-Arabian Pipe Line Company (Tapline), subsidiary of Arabian American Oil Company (Aramco), had been allowed 25,000 tons of steel pipe for export during the current quarter. The license had been held up nearly a year while bitter dispute continued around the issue of exporting steel in the face of a steel pipe shortage in the U. S.

The latest debate centers on the relation of the Tapline project to the U. S. Military Establishment. Secretary Sawyer first revealed that "Tapline has agreed to transport for the National Military Establishment, at cost, substantial quantities of oil from the Persian Gulf to the Mediterranean, for a period of ten years after completion of the pipe line." For details Sawyer referred the matter to the Navy, but Navy officials dodged all inquiries.

It is generally admitted that there is much more involved in the export license approval for Tapline than has been disclosed, and many industry observers take the position that the government action in effect hoists the U. S. flag over the pipe line as a notice to the world that the U. S. has committed itself to a stake in the Middle East and dollar oil from Saudi Arabia.

To offset implications of this kind, the military finally declared that neither then-Secretary of Defense Forrestal nor Under Secretary of the Navy Kenny (now chairman of the Armed Services Petroleum Board) had participated in the decision to grant the export license. However, Russell B. Brown, general counsel of the Independent Petroleum Association of America, raised the following questions:

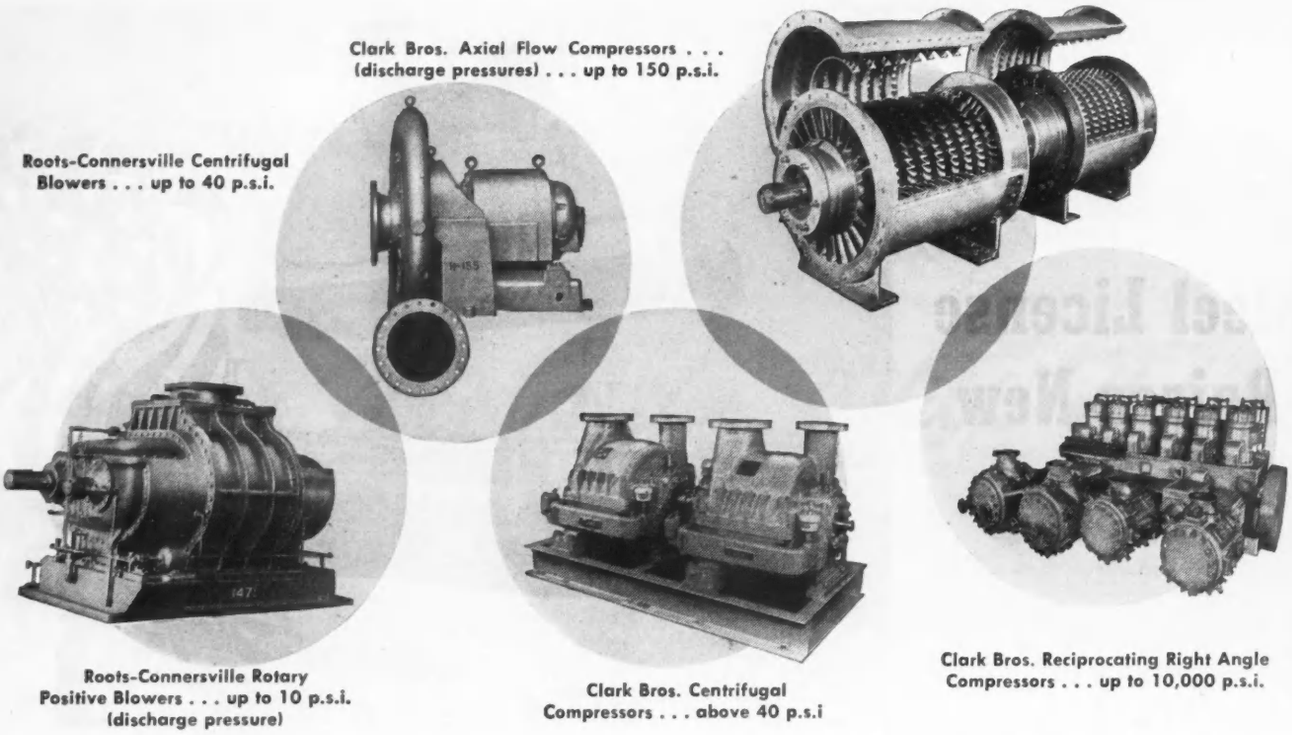
1. What formal, signed agreement has been made between Tapline and the military; or is the "agreement" simply verbal?
2. If a formal agreement exists, has the military agreed to perform any service for the other parties to the agreement, such as protection or defense of the line?
3. Is there any legal authority for a ten-year agreement when normally authorizations for programs are carried on on an annual basis?
4. Does the agreement in effect establish a property right for the U. S. government in the pipe line?
5. The line is designed to transport crude. The military does not use crude. What further steps would be taken at the Mediterranean end of the line to convert the oil transported into usable products?

Congressional investigation of the whole matter is called for by Brown and by Senator Kenneth S. Wherry, Republican Senate whip and former head of the Senate Small Business Committee who opposed the pipe line program. Brown charged:

"There has run a consistent thread through all this—the government of the U. S. was committed by certain officials to a course of securing the position of the oil companies which held the Arabian concession. Secretary Ickes early in 1944 announced that an agreement had been made which would reserve for the Navy 1 billion barrels of oil at a price below the going market price. It was presumed that this agreement ended when the government pipe line was killed. Yet in the November 27, 1948, issue of the *Saturday Evening Post*, in an article entitled 'Allah's Oil,' Author Leigh White referred to a reservation of 1 billion barrels of oil for the Navy in Saudi Arabia at a discount of 25 percent below market price. White went to the Middle East to get material for his articles. An editor of the *Saturday Evening Post* wrote us that a governernment official was the authority for the statement mentioned above."

Brown contends that if the military has been given a stake in the pipe line, that fact constitutes an obligation "to back up the right with arms."

Meanwhile Tapline was proceeding with plans to ship pipe now stacked on the Pacific Coast docks. The recent approval brings to 79,000 tons the amount of pipe so far approved for the trans-Arabian line. About 260,000 tons will be needed to complete the project.



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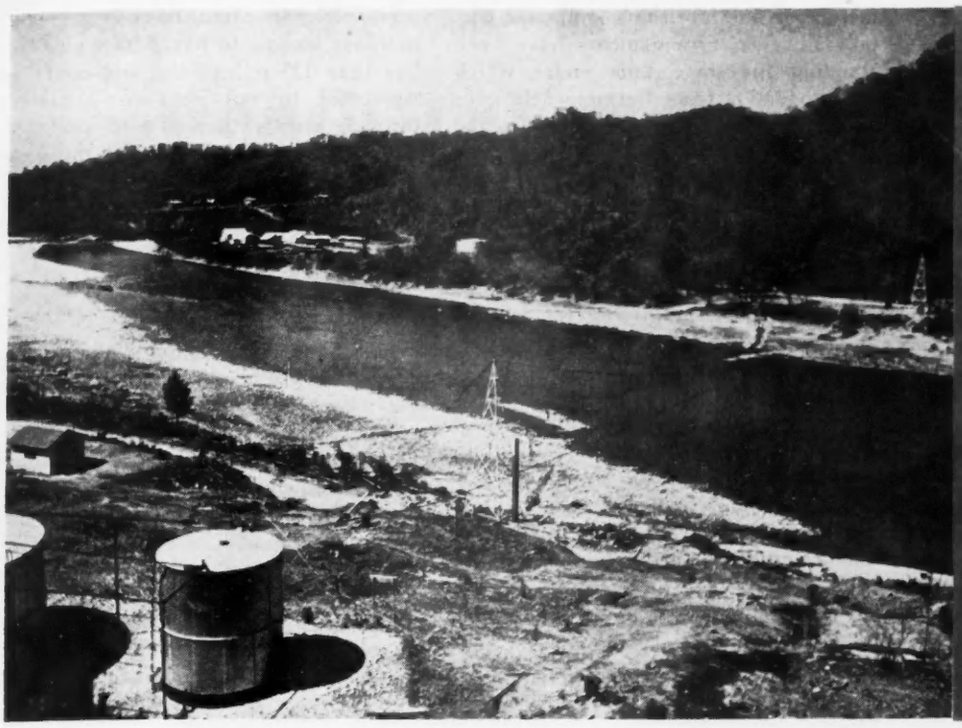

Bolivia

Solving Supply Problems

Bolivia's Bermejo field. The Agua Blanca field of Standard Oil Company, Argentina, is on the near side of the river.

BOLIVIA'S program for the development of its oil industry centered around three main factors during 1948, and will continue so through 1949. From an over-all viewpoint the program is designed to provide for the immediate necessities of the country as it concerns petroleum products, and currently calls for emphasis on the following:

1. Development of the Camiri field to the point where its production will be sufficient to supply enough crude for the country's requirements.
2. Construction of a six-inch pipe line from Camiri field to Cochabamba with a four-inch spur line to Sucre. The completed program will include 355 miles of six-inch and approximately 50 miles of four-inch.
3. Erection of two refineries, one of 5000-barrel daily capacity at Cochabamba and one of 3000 barrels daily throughout capacity at Sucre.

New Areas Sought

However, the progress of realization of these three principal objectives has been such that Yacimientos Petroliferos Fiscales Bolivianos (YPFB) is now to the point where they will soon need to be broadened considerably. The agency is now giving considerable attention to finding and developing new producing areas in the hope that these may result in providing sources of supply for crude oils of greater versatility as regards the range of products obtainable. Thought is being given to the possibility of exports of some products.

In respect to the construction of the pipe lines and refineries, officials of YPFB estimate that delays have been suffered amounting to at least a year in final completion. The most serious obstacles having been the difficulties experienced in maintaining a steady flow of materials from the U. S. However, with improvements in supply it is now thought that both projects will be completed during the current year. The work was speeded up considerably during the latter part of 1948 and early 1949. The pipe line project is being constructed by Williams Brothers as contractors, and the building and maintenance of the refineries is under the direction of Foster Wheeler Corporation.

On the other hand the drilling program in the Camiri field has brought results which have exceeded by 100 percent the expectations of the operators at the beginning of 1948. Although only five wells have been completed, four of which were productive, it is felt that potential will be ample to supply the pipe lines and refineries by the time they go into operation. Meanwhile, at least one rig has been maintained in operation in the Sanandita and Bermejo fields, the two other commercially producing areas of Bolivia, and two rigs have been maintained in exploration of the newly discovered structures of Guayruy and Mandeyapecua. The latter area was previously known as the Presidente Busch prospect.

Field Partly Defined

Of the five wells drilled at Camiri, two have been of great value through having served to partially define the structural limits of the field. Camiri 40, on the west flank of the structure, penetrated sands in the Devonian which were found to contain salt water, and Camiri 24, also on the west side of the structure, found two zones in the Devonian, one of which contained salt water, the other containing oil.

Another well, Camiri 22, gave important information from the standpoint of sedimentary conditions in the field. Drilling this well confirmed the existence of two distinct producing zones, separated by well-defined impervious strata.

Actual production from the Camiri field during 1948 amounted to 267,438 barrels, or 102,929 barrels more than

this field accounted for during 1947. The current rate of 730 barrels a day is a limitation, not of the potential productive capacity of the field, but of the ability of the refinery and distribution facilities to handle the crude and products. All this production is now going to a small skimming plant, operated at Camiri field, which was charging less than 700 barrels daily at the beginning of the year, although it has a rated capacity of 1380 barrels daily. Although it has not been possible to operate the field at capacity, intermittent tests made on the 12 producers now completed indicate that total output of the field could be maintained at about 3500 to 3800 barrels daily. Through the current program by which eight rigs are maintained in the field, it is estimated that production from Camiri will be brought to more than 5000 barrels daily by the end of 1949.

The other producing fields, Bermejo and Sanandita, have received little activity during the present program, and it is unlikely that there will be any change in their producing rates during the next year. YPFB has concentrated the use of its rather scanty supply of materials in the Camiri field. Production from both these fields showed a slight decline during 1948, producing 88,821 barrels and 110,301 barrels, respectively; but these declines were more than offset by the increase in output from Camiri. As a whole Bolivia produced 463,560 barrels of crude in 1948 to compare with 377,362 barrels in 1947.

Heavier Crude Wanted

Although Bolivians are somewhat encouraged by the success of development in the Camiri field, which now assures that the nation will have a sufficient supply of aviation gasoline, motor fuel, kerosine and diesel fuel, some concern is felt over the failure thus far to develop a source of heavier crude. Camiri crude averages 53.1 degrees gravity, and yields as high as 63 percent gasoline through topping only, but consequently has a very low content of medium and heavy fuels. At current rates of consumption the available sources of supply will still leave Bolivia about 50 percent short of its fuel oil requirements. One new field, Guayruy, was discovered in December, 1947, but this field, which produced also from the Devonian at 1731 feet, showed oil of 57.8 gravity, even higher than that of Camiri. In view of this, no further development is being undertaken for the time being.

In this connection, crude from the Bermejo field has a gravity of between 25 and 26, and is suitable for the manufacture of fine lubricants and some fuel oil. However, arrangements have been standing for some time under which the production from Bermejo field goes to Argentina, finally ending up in the Argentine YPF's refinery at La Plata in the Buenos Aires area. At any rate the field is on the southernmost border of Bolivia and transportation of this crude, of which there is only about 250 barrels daily, would pose a major problem if taken to the interior for refining and distribution. This particular crude differs considerably from the Camiri production in that recovery of gasoline on topping processes amounts to only 8 percent as against 63 percent at Camiri. On the other hand the initial gasoline product from Bermejo crude has an octane number of 81 while that from Camiri crude is only 47.

One of the structures being explored in the ambitious undertaking to find enough crude to make the country self-sufficient as to both quantity and quality, and perhaps result in the possibility of strengthening the internal economy through export of oil, is the one at Mandeyapecua, where YPFB has already proved the existence of oil in commercial quantities in a well now actually drilling. It was still going ahead below 2700 feet, expecting to stop for the final series of tests somewhere around 4600 feet. At this depth it should be about 1500 feet into the Devonian. Operators are of the opinion that this one field should furnish enough oil to make the nation a net exporter of oil to other nations in the vicinity.

To further the possibilities of expanded productive capacity, the agency has pursued the study of the petroleum possibilities of other regions throughout the portions of the nation which contain favorable sedimentary areas, with special emphasis on the areas which, through their geographical position as well as their geological merit, would permit exportation on a large scale to other countries in the region, either of crude or refined products.

As a result of preliminary studies it has been found that the region of Izozog is of considerable importance, not only for its petroleum possibilities, but also from the standpoint of transportation to markets in Brazil, Paraguay or Argentina. The located structure is about 65 miles northeast of Camiri field, and received considerable attention during the past year. A topographic survey was made, followed by reconnaissance work by geological parties. It is now in line for work by geophysical crews and the authorities have little doubt that this work will result in recommendations for actual wildcat drilling. Should it prove productive, it could be connected to railroads leading to Brazil by a pipe line less than 125 miles long, and could be connected to rail lines to Argentina through construction of a 65-mile pipe line. This prospect is among the most promising in the country. The presence of oil has been proved in a shallow test drilled by engineers to less than 175 feet.

In connection with the work on the Izozog area itself, a survey is being made of the entire region. This includes a study of aerial photographs taken by the government's aviation section. The photographic survey has already been completed and the study is to be finished in another couple of months. Work is also going forward on roads and bridges over which it will be possible to move drilling equipment and other necessary material for the establishment of a wildcat drilling camp. It is estimated that all preliminary work will be completed in time to start the first deep test well in September or October of this year, so that the results will be known within the first couple of months of next year.

Another Structure

Another structure of considerable interest is being explored in the Los Monos area, about 36 miles north of the Sanandita field in the extreme southern part of Bolivia. This area was first worked by Standard Oil Company of Bolivia at the time they held concessions, and resulted in the outlining of a tentative structural area. Later work by the YPFB geologists resulted in location of the first test well which, although it did not produce, proved that Devonian sands were developed at depths of less than 2000 feet. Current plans call for eventual resumption of wildcat drilling to define the structure and determine whether or not oil exists in commercial quantities.

The Bolivian government attaches great significance to its program of developing its oil resources. It has pointed out that the imports of motor gasoline and kerosene alone to the Departments of La Paz, Oruro and Cochabamba in 1947 required the expenditure of $1.2 million. It is estimated that the rate of consumption of increasing at the rate of 15 percent per year, and high prices of petroleum products plus the extremely high transportation costs into this rugged country make the nation's self-sufficiency of primary importance, since with the removal of oil products as a source of expenditure it will be possible to devote themselves more fully to the development of other industry so necessary to its precarious economy.

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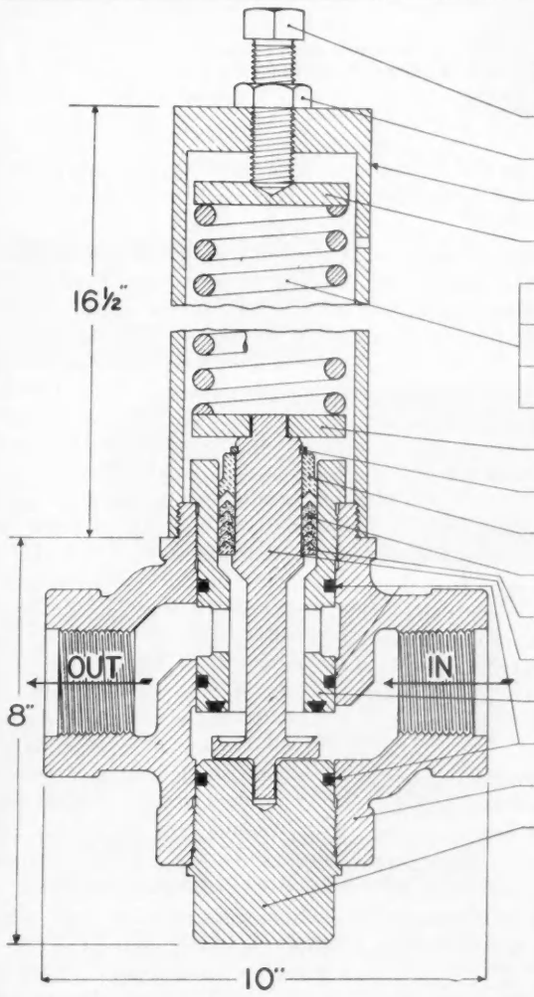

Part No.	DESCRIPTION	Unit	Units Required	Unit Weight, Lbs.	Unit Price	Spares One Year
31	Set Screw	Each	One	1.25	$ 0.83	..
32	Lock Nut	Each	One	.20	.28	..
33	Spring Cap	Each	One	22.00	28.60	..
34	Spring Plate—Top	Each	One	1.50	1.65	..
51	Spring—3/8"—60 to 100 lbs.	Each	*	3.50	13.75	..
35	Spring—1/2"—100 to 250 lbs.	Each	*	6.00	13.75	..
36	Spring—5/8"—250 to 500 lbs.	Each	*	9.00	13.75	..
37	Spring—3/4"—500 to 800 lbs.	Each	*	12.50	13.75	..
38	Spring Plate—Bottom	Each	One	1.50	1.65	..
39	Snap Ring	Each	One	.03	1.10	1
52	Junk-Ring, Female	Each	One	.44	3.30	1
53	Chevron Packing Rings	Set of 4	One	.10	3.95	1
42	Junk-Ring, Male	Each	One	.13	2.20	1
54	Piston Valve	Each	One	3.00	17.60	1
55	Cylinder Sleeve & Valve Seat	Each	One	6.00	30.00	1
56	"O" Ring Seals	Set of 3	One	.09	3.30	1
57	Valve Body	Each	One	37.00	96.70	..
58	Bumper Plug	Each	One	9.00	*20.12	..

***Valve comes equipped with one spring of size specified. It is recommended that sufficient extra springs be ordered to cover the anticipated range of opening pressures required.**

Purger works on 15% differential, e.g. if purger opens at 240 lb, it will close at 276 lb.

Export Representatives

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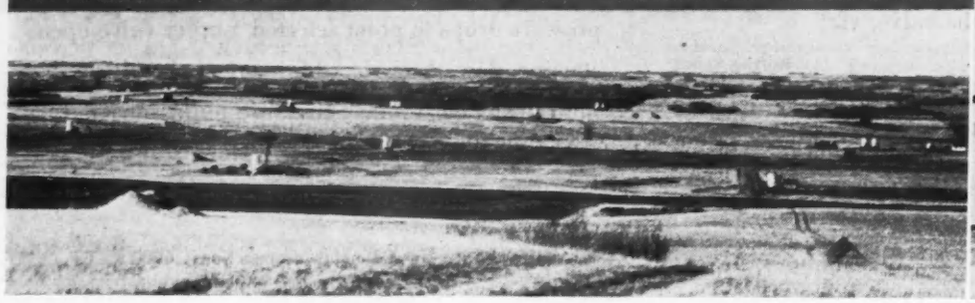
Canada's Leasing Boom Spreads to Saskatchewan



LEFT: Looking over the Lone Rock field, substantial contributor to Saskatchewan's production.
RIGHT: Heavy rig being used in prospecting for deeper formations around the Lloydminster field.

THAT the possibilities of expanded oil development in Saskatchewan have caught the imagination of oil men is evident through information made available by J. H. Brockelbank, Minister of Natural Resources of the Province of Saskatchewan. Exploration permits have been received since early in December, 1948 covering about one-third of the Crown mineral rights in the southern half of the province.

Permits have been issued to many companies and individuals, both large and small operators, covering more than 17 million acres. While most of the land involved runs along the western border, huge blocks have been taken up in the area north of Yorkton, south of Quill Lake, surrounding Hudson Bay, and in the southeastern corner of the province.

According to Brockelbank, there are two reasons for the boom:

1. Most of Alberta's oil lands lying near transportation facilities have been taken up.

2. Oil men are beginning to realize that Saskatchewan's mineral development regulations are among the simplest and most straightforward in Canada.

This latest development, covering such a large area and involving a large number of independents, is in contrast to the period prior to 1944, when the only dispositions of acreage were to one large monopoly. In all recent permits, the government is retaining 25 percent of the land involved in each permit area, and setting it up as a part of the Crown reserve, seeeking thus to avoid monopoly of great areas by one concern.

To date the permits issued are divided as follows: sub-surface, 15; geological and geophysical, 22; applications for geological and geophysical permits being processed, 26.

The sub-surface permits cover areas ranging from 27,000 to 34,560 acres each. Geological or geophysical permits range from 88,000 to 251,040 acres each.

Private Lands Sought

The 17,840,292 acres now under permit comprise Crown land only. It is not known at this time how much private land or mineral rights on private land have been taken up. However, one major company is searching titles and approaching land owners in the areas involved.

Before the boom, the government had issued permits on oil lands covering 5,779,252 acres. The boom began about December 1, 1948, and in the days following applications were recorded for rights on 12,061,040 acres, bringing the total to nearly 18 million acres as indicated above.

The bulk of this acreage along the province's western boundary from the U. S. border and northward about 365 miles to Township 61, which is about 70 miles north of Lloydminster. These land deals extend as far east as Saskatoon and the Rosthern area. No further geophysical permits are being granted in the area north of Township 47, due to the forested nature of this country, with consequent danger from fire and other destructive features of geophysical methods of exploration.

To the east, five other areas are involved, covering 3 million acres. The largest of these is the Hudson Bay block of more than a million acres stretching from a point 110 miles northeast of Saskatoon almost to the Manitoba border. South of Quill Lake another block covers ½ million acres. This extends to a point just north of Regina. Northwest of Yorkton a block of 250,000 acres has been leased, and about 28,000 acres are held at Kamsack. The fifth block comprises 250,000 acres and flanks and the U. S. Cooperatives are also the southeastern corner of the province.

While Husky Oil and Refining, Ltd., is the largest single holder of Crown rights, other holders are small business groups with headquarters in all parts of Canada and the U. S. Cooperatives are also interested in this development.

The government fee for a 250,000-acre permit is $250 plus a $500 deposit, returnable when required work has been carried out. The term of a geophysical or geological permit is one year, renewable for three quarterly periods, making the maximum life of the permit 21 months.

Royalty schedules are 5 percent on sale value of natural gas with oil royalty ranging from 5 to 15 percent based on

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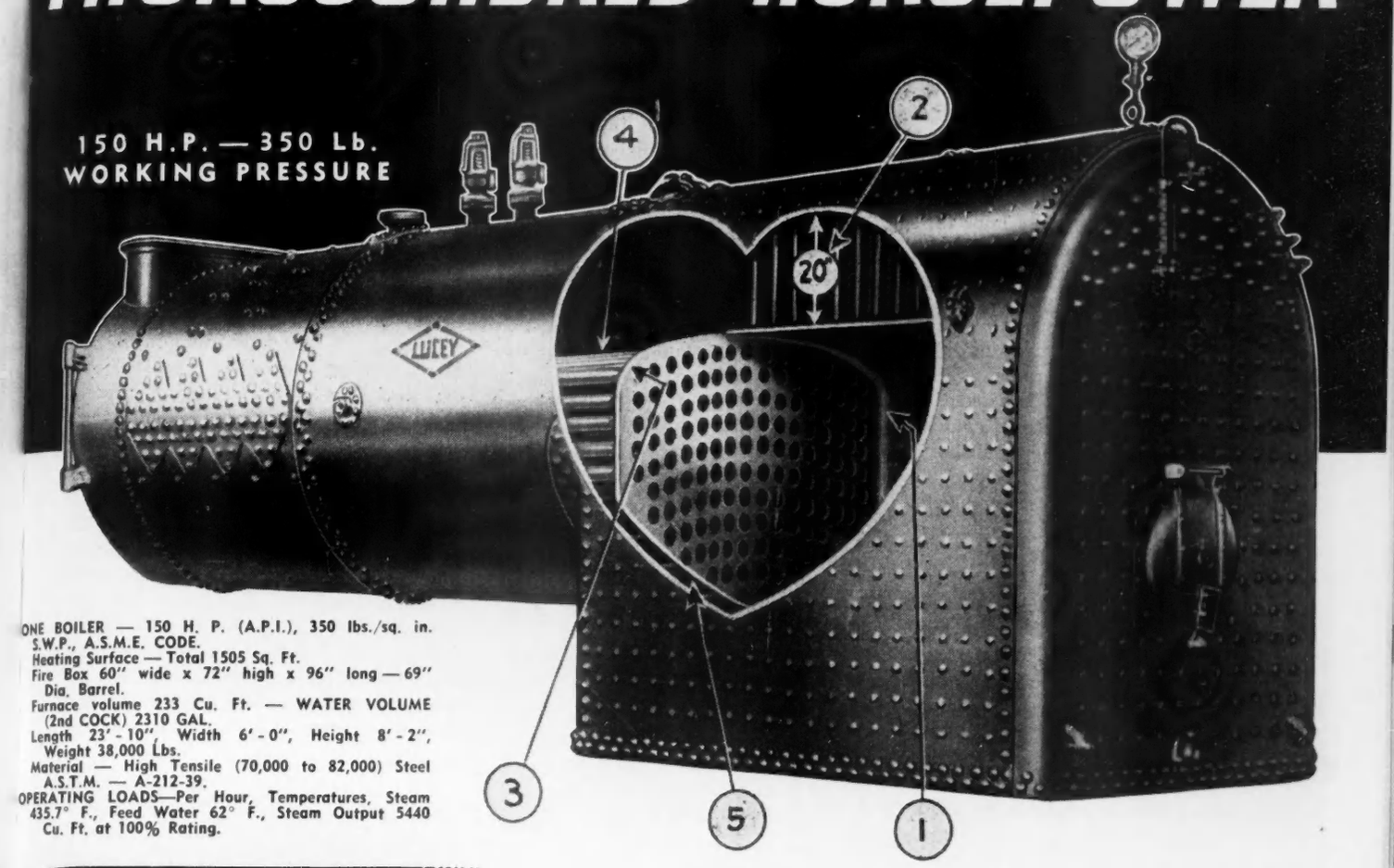
150 H.P. — 350 Lb.
WORKING PRESSURE



ONE BOILER — 150 H. P. (A.P.I.), 350 lbs./sq. in. S.W.P., A.S.M.E. CODE.
Heating Surface — Total 1505 Sq. Ft.
Fire Box 60" wide x 72" high x 96" long — 69" Dia. Barrel.
Furnace volume 233 Cu. Ft. — WATER VOLUME (2nd COCK) 2310 GAL.
Length 23' - 10", Width 6' - 0", Height 8' - 2", Weight 38,000 Lbs.
Material — High Tensile (70,000 to 82,000) Steel A.S.T.M. — A-212-39.
OPERATING LOADS—Per Hour, Temperatures, Steam 435.7° F., Feed Water 62° F., Steam Output 5440 Cu. Ft. at 100% Rating.

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2 20" BETWEEN TOP OF FIRE BOX CROWN AND OUTSIDE WAGON TOP WRAPPER. Plenty of steam space with two gauges of water compensating for absence of dome.

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daily average production in each month. The oil royalty starts at 5 percent on a production of 30 barrels daily or less, 10 percent on daily production from 91 to 110 barrels a day, and 15 percent on production of more than 200 barrels a day.

Although Saskatchewan is for the most part merely a continuation of the great prairies of Alberta, with no geological break to cause any less hope for oil occurrence than in Alberta, that province has received little activity until recently due to uncertainty of the status of companies which might operate there under the rules and regulations as laid down by the provincial government. The only commercial production has been in the Lloydminster region region which straddles the Alberta-Saskatchewan border, and includes the Lone Rock area. It is an area which produces heavy, black oil of 14-18 degree gravity from relatively shallow depths ranging from 1750 to 2000 feet. It received a substantial spurt in drilling activity during 1947 and 1948 with the result that its producing potential has been raised to approximately 6800 barrels a day. However, during the latter part of the year the fields have been held back to substantially less output than that to keep the yield in line with the capacity of local refineries to turn out products localy in demand from this heavy oil. The schedules regulating production are set up on the basis of findings in conference between the producers and the refiners. Thus far its demand is limited to the manufacture of bunker fuels and asphalts with only a relatively minor percentage of white products.

Production of crude from the province reached an all-time high in 1948 of more than 846,000 barrels, an increase of 300,000 barrels over the previous year and six times the amount produced during 1946. For the first time oil was produced from wells outside the Lloydminster area when two outlying wells went on production during the latter part of the year. One of these new areas is almost 100 miles south of the Lloydminster field and the other is about 32 miles south. There are now 140 wells in Saskatchewan capable of production, although it is rare that more than 100 of them are on production at the same time, the largest number being in October, when 113 wells were produced. With the necessity of holding back production to local demand, it is not necessary to produce at full potential. The need for restriction to local demand is forced by several factors, one of the most important being high existing freight rates which make it impossible for the products to compete in markets to the west and east. A further restrictive effect is felt by the Dominion sales tax of 8 percent on Bunker C fuel, which is one of the main uses of this kind of oil. Local observers feel this tax penalizes the fields unduly, since this is the only industrial fuel carrying such a tax.

Development during the past year centered mainly around the Lloydminster area, where 59 wells drilled represented a total footage of 114,506 feet. Steel shortages and the market conditions mentioned above prevented drilling activity from reaching the 1947 record of 99 wells. Of the wells drilled during 1948 at Lloydminster, 33 are now producing oil, 13 are standing with casing set, two are gas wells and 11 abandoned as dry holes. Twenty-nine of the wells were drilled in the Lone Rock field, 21 in a Lloydminster field, 3 in the McLaren area to the east, 2 near Lashburn, 2 in the Dina area and 1 at Paradise Hill. Development in the field was led by Husky Oil & Refining, Ltd., which drilled 14 wells, followed by Command Oils, Ltd.—Globe Oil Company, Ltd., with eight. Others drilling more than one well were Saskatoon Syndicate 4, Franco Oil and Gas Company 3, Castle Petroleums 3, Phillips Petroleums, Ltd., 3, Bata Petroleums, Ltd., 2, Imperial Oil, Ltd., 2, Lloydminster Gas Company 2, and Marion Oils 2.

Results Encouraging

Results were encouraging in that the field was extended, areas were opened, and others showed promise of future development. Four miles west of Marshall three wells went on production to open an area east of any previously producing well.

Fourteen miles east of Lloydminster Husky brought in a wildcat from the Colony sand of the Lower Cretaceous, the only producing well in this horizon. The nearest producing well in any direction is ten miles away. In the township northeast of this discovery, Husky drilled two other wells which did not produce but which had showings indicating good possibilities in the area.

Thirty-two miles south of Lloydminster, Bata Petroleums completed a well in the Dina area which went on production during November from the Sparky horizon.

In addition to these, other wildcats in the area encountered oil sands which, although none made wells, indicated oil may be found in the vicinity. Phillips Petroleums drilled two just west of Lashburn which had some good showings of oil, and Husky drilled a well near Paradise Hill, 40 miles northeast of Lloydminster which had oil shows in the Lower Cretaceous. This well was drilled to 3217 feet and penetrated the Devonian limestone.

The drilling program and its results to date have solidified opinions that reserves in proven areas will continue to expand and that much new reserve remains to be discovered. Development of new areas should follow rapidly an intensified wildcatting campaign made possible by the entry of the many substantial operators into Saskatchewan.

Nearly 100 miles due south of Lloydminster, Bata Petroleum completed the first commercially productive well which can be considered as being outside the general Lloydminster area group of fields, located near the Alberta border 24 miles south of Macklin. Drilled to 2803 feet, it found production in the Unity sand of the Lower Cretaceous at 2432 feet. The oil is similar in character to that of the Lloydminster field.

The Bata and Superior firms also drilled a well 20 miles southeast of this discovery near the town of Major which found some interesting showings of oil in the lower 70 feet of the 2789-foot well. The showings were in a formation of limestone followed by shales and silt with oil saturation and then a highly porous sand. Additional drilling will probably be carried out here since there is reason to believe that this lower sand should produce if proper structure is located.

Farther east, Husky Oil & Refining, Ltd., drilled a wildcat, Spinney Hill 1, midway between Battleford and Saskatoon which found oil and gas showings in the Lower Cretaceous formations but did not go to the limestone beds in drilling to its total depth of 2464 feet. At Battleford an old well which had been drilled to 2645 feet during 1946 was deepened to 3222 feet and found salt from 2763-3150 feet. Other wildcatting during the year was carried out in the area south of Prince Albert, west of Maple Creek, and at Meadow Lake. Nearly all had showings, but few were drilled deep enough for a test of the limestone sections.

Possibilities for the future are considered extremely attractive in view of the many showings found in shallower drilling, and the fact that the Lower Cretaceous formations have been found so productive at Lloydminster. It is thought to be only a matter of time before production is obtained from the Paleozoic formations. Thus far very little of the dry hole drilling has been conclusive. In Saskatchewan there, no more than 331 wells have been drilled below 1000 feet. Of these, 227 were drilled in the Lloydminster field, leaving only 104 wells drilled to date in the remainder of the province. This amount of drilling is insignificant when it is realized that more than 170,000 square miles of the province of Saskatchewan are underlain by sedimentary rocks favorable for prospecting for oil and gas.

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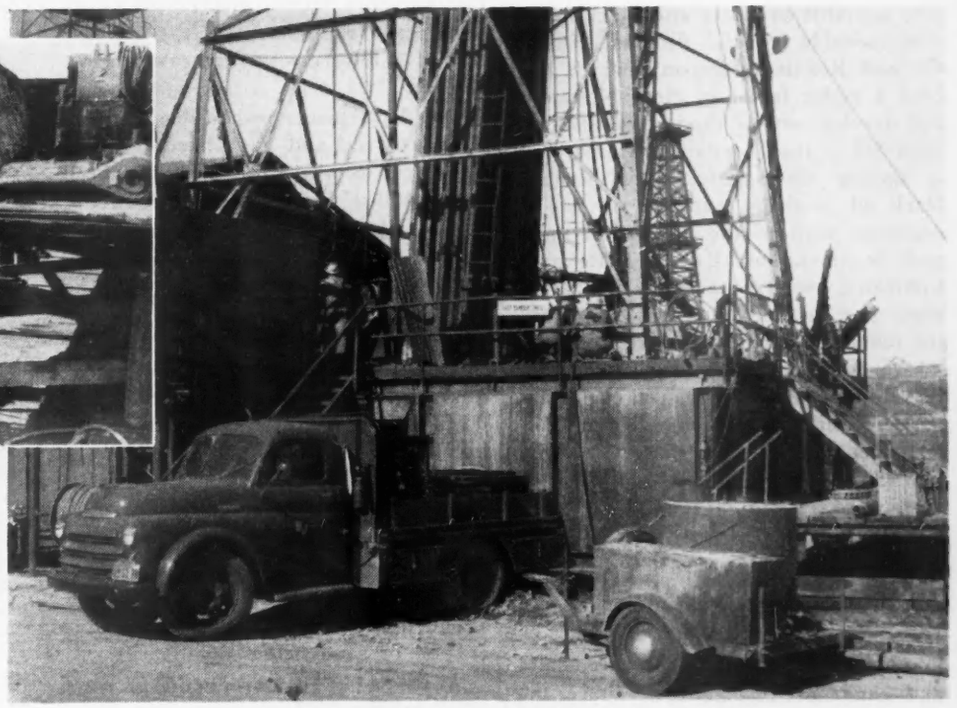

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The commencement of operations at Imperial Oil Company's new Edmonton refinery has already made itself felt in the demand for products from the refineries in the Lloydminster area, since some of the residual materials from the Edmonton plant are filling a substantial part of the railroad demand which has been one of the chief outlets for Lloydminster crude.

As a result, two plants at Lloydminster are now being altered and enlarged to manufacture a more complete line of products, such as industrial fuels, road oils, asphaltic products and other items more suitable to local demand. Husky Oil and Refining Company, which has been a major factor in the exploitation and development of the several shallow oil fields of the Lloydminster area, and in finding markets for their peculiar black oil products, expected to add a cracking plant to the distillation units now in operation. Excelsior Refining Company, owner of a small distillation plant now in operation, has purchased the refining equipment formerly used by Abasand Oils, Ltd., in connection with its oil-mining experiments on the Athabasca River in northern Alberta. This equipment is to be put in service some time this spring.

Nearly all of the Lloydminster production is from the "Sparky Sand" of the Manville formation, which is found from 140 to 200 feet below the top of the Lower Cretaceous. Drilling to these formations is rather easy, since only shales and sands are encountered above the producing sands, and wells can be drilled in from three to seven days, actual drilling time. At present there are five rigs in operation, of which two are being run by Husky Oil and Refining Company and one each by Commonwealth Drilling Company, Ltd., Union Drilling Company, Ltd., and Exterior Oils, Ltd.

Of particular interest is a program of deeper drilling and wildcatting around the producing area on both sides of the border. In an area about 40 miles northeast of the field, Husky Oil & Refining Company and Jet Oils, Ltd., have associated themselves for the drilling of a deep test scheduled to the Devonian lime in search of light oil corresponding to the production at Leduc and Redwater.

A similar operation was recently carried out on the Alberta side of the field, where the Blackfoot Devonian Test Syndicate was formed by a group of operators in the Blackfoot area to drill a test to the Devonian. However, this test failed to show production in the deeper formation and was plugged back and completed in the Sparky sand.

The Husky-Jet group recently drilled a test two miles north of Lloydminster production and found oil in a 20-foot section of sand below the Sparky.

At the end of 1948, production of heavy oil from the Saskatchewan side of the Lloydminster group of fields was being held to slightly more than 1500 barrels daily. The average for December was 1526 barrels daily. Total production from Saskatchewan wells during the year amounted to 851,409 barrels, a substantial increase from the 540,117 barrels produced in 1947. Currently, only 92 wells are on production in Lloydminster, Lone Rock and Dina fields. Of these 54 are on private, freehold lands, and 38 are on Crown lands, with production divided 27,880 barrels from freehold leases and 19,427 barrels from Crown property during December. Due to the fact that demand for the heavy oil is largely local, with fluctuations from month to month, the production rates and the number of wells on production during any month will vary considerably. In November, 1948, the area produced 2634 barrels a day from 103 wells, compared to the output of 1526 barrels a day from 92 wells in December, and earlier in the year had recorded an output of 3100 barrels a day from 90 wells. The greatest number of wells actually on production in any one month was in October, when 113 wells contributed to the output from the fields.

USSR Reports Oil and Gas Production Increase in 1948

CRUDE oil production in the USSR, according to official Soviet statements, has shown an increase of 13 percent in 1948 over the output in 1947, and in the same period the Soviets say that production of natural gas has increased by 10 percent.

The departments responsible for production of oil and gas stated that the production plans for 1948 had been "overfulfilled" by 8 percent.

Since all estimates of actual production in the Soviet Union would have to be calculated from what amounts to no more than estimates of the output in certain previous years, the figure arrived at is still somewhat uncertain, but economists agree that the actual production during the past year was about 214 million barrels. The goal of the plan was for a production of 247 million barrels of crude in 1950, and authorities have recently indicated that they hoped to reach this goal in 1949. This would call for a 15 percent increase in production over 1948.

Although oil well drilling was said to have increased by 28 percent over 1940, it was also indicated that the drilling goal for the year was not fulfilled as regards exploratory drilling. Refineries seem to have continued their progress, judging from the increases in the output of gasoline and kerosine during the year, amounting to 12 percent and 17 percent, respectively. At the same time the Soviet railroads reported a 16 percent increase in daily average oil loadings as compared with the previous year.

One of the interesting developments in crude production is the apparent change in the center of gravity of crude sources. Russians say the Eastern fields, which include the so-called Second Baku of the Ural-Volga regions, increased their output by 19.3 percent over 1947, while the Western and Southern regions, which include the old established fields of the Caucasus, with Baku as the principal producer, increased only 6 percent over the previous year. This is regarded as proof, not only of the slow recovery due to the extensive damage of the scorched earth policy at the time of the German invasion, but also of the progressive depletion of some of the older fields of the area, which have long been the principal sources of Russian crude oil production.

It is thought that the production from the Baku area last year is not likely to have been much more than half of its prewar rate of 154 million barrels a year. The entire Western and Southern regions' estimated output for 1948 was 110 million barrels, while that estimated for the Eastern regions was placed at 104 million barrels.

The following series of estimates for several previous years shows the breakdown between production from the two general subdivisions of Russian territory.

(Thousands of Barrels)

YEAR	Western and Southern Regions	Eastern Regions	Total
1940	191,000	26,000	217,000
1945	93,000	47,000	140,000
1947	102,000	87,000	189,000
1948	110,000	104,000	214,000

Planned for Philippines

ONE of the important matters for study by the current Philippine Legislature, now in session, is the possible passage of entirely new petroleum statutes, and it is quite possible that the oil policy and regulations may be patterned after those of Venezuela.

With a considerable portion of the archipelago consisting of territory which may be termed favorable for oil exploration, the republic is giving renewed attention to possibilities of early evaluation of its potentialities for oil production. Regulations under which past and current operations are being carried on have been in force since 1920, with the exception of a period following 1939, when they were suspended. Philippine officials feel that the petroleum code is out of date. Some petroleum activitiy is being carried on under special regulations, but the oil law remains suspended pending adequate new legislation. The period of suspension is to expire in May, 1950, and the administration is encouraging every effort to see that proper rules are passed before that time.

With this in view, Ing. Demetrio Andres, director of the Bureau of Mines, and executive secretary of the Philippine Oil Commission, was sent by his government to make an extensive survey of the industry in Europe and the Western Hemisphere; to make a study of oil laws and regulations in the various nations; and to draw some conclusions as to their over-all effect on petroleum development. With him was attorney Pascual Bautista, also of the Bureau of Mines in Manila. They were to reach the Philippines in mid-February, prepared to make recommendations to the legislative body. Upon the results of their study will hinge the future oil policy of the republic. Their journey has taken them through Western Europe, including England and France, and has also included a study of conditions in the Middle East. About six months were required for the entire survey, and a good part of that time was spent in the U. S.

Andres and Bautista spent a number of days in Houston and the Houston area, during which time they were given an opportunity to inspect every type of oil operation and oil installation, including marine operations, cycling plants, refineries, oil and gas fields, and handling and shipping facilities. They expressed extreme pleasure with the manner in which they had been received throughout the U. S. and said that they had been given every assistance in trying to work out the solution to their current problems.

Visit Federal Agencies

In Washington they conferred with representatives of the State Department and agencies such as the Bureau of Mines and the United States Geological Survey. In addition they consulted with state regulatory bodies such as the Railroad Commission of Texas, and have gathered a great deal of material for study. Their problems differ somewhat from those in most producing areas in the U. S. where sub-soil rights are held by private individuals, but problems of conservation and engineering were of great interest.

The Philippine representatives were scheduled for a conference with officials of Petroleos Mexicanos in Mexico City late in January but before leaving the U. S. expressed to WORLD OIL the conclusion that the oil regulations in Venezuela seemed most likely to meet the particular needs of their republic. In the course of their investigations while in the U. S., Andres and Bautista talked with officials of some of the leading U. S. oil companies to get their views, and indicated that interest has been expressed in the opening of the republic to foreign capital on an orderly basis. Among companies visited were Standard-Vacuum Oil Company, Gulf Oil Corporation, Sinclair Oil Corporation, the Atlantic Refining Company, American Independent Oil Company, the new Conorada organization, and Union Oil Company of California.

Two organizations are now doing some business in the Philippines. The Far East Development Company drilled a deep wildcat on the island of Cebu which went to a depth of 9950 feet before reaching basement in schist. Showings were reported and acreage is being retained. It was placed on record as being suspended pending possible testing at some later date. The concession covers around 6000 hectares (14,826 acres). The same company also holds a similar area under concession on the island of Luzon, including about 300 hectares (740 acres), on Bondoc Peninsula. One test is now drilling on Luzon, but other than some shows of gas at a shallow depth it has not been reported on since reaching depth below 5000 feet.

Philippine Oil Development Company has been doing some reconnaissance work in preparation for possible securing of acreage. This concern is owned by American, Philippine and a small amount of outside capital. Under the law, at least 60 percent of the stock in all companies dealing with minerals must be owned by Americans or Filipinos. A constitutional amendment

PHILIPPINES GROUP IN U. S.—Representatives of the Philippines Republic consult with the Texas Railroad Commission. Left to right are: Stanley Hornsby, Austin attorney; Paul Weaver, chief geophysicist of Gulf Oil Corporation; Gen. Ernest O. Thompson, member of Railroad Commission; Demetrio Andres, director of Philippines Bureau of Mines, and ex-officio chairman of the Philippines Oil Commission; William J. Murray, Jr., chairman of the Railroad Commission; Pascual Bautista, chief attorney for the Philippines Bureau of Mines; Olin Culberson, member of Railroad Commission. Weaver conducted the visitors on a tour of Texas Gulf Coast and Southwest Texas where they had an opportunity to observe all phases of the oil industry.

passed at the time the republic received its independence guaranteed Americans equal rights with Filipinos until 1974.

A surface geological survey conducted in the Philippines during the period from 1938 to 1941 has made available a good general knowledge of the geology of the islands. A geological map is available, and it is estimated that some 37 million acres, or roughly half of the area of the Philippines, is covered by sedimentary formations which are comparatively deep over a large portion, and are mostly Miocene to recent in age. Many oil seeps are in the islands, and geologists have traced some of the strata which compare to the producing zones in the Netherlands East Indies fields.

Apparently the sedimentary basins are distributed pretty well throughout the archipelago, and almost without exception are said to be easily accessible to transportation, by water for the most part.

Andres expressed the hope that a petroleum law would come out of the legislature which would attract substantial operators and speedily establish the extent of their petroleum resources. He thinks conditions are attractive on the whole, since the government is based on principles which make for stability. During the American rule the Filipinos learned much more of political science than they did of economics. They have essentially the same constitution, the same Bill of Rights and the presidential powers are approximately the same as in the U. S. As to labor, Andres indicated that although it is being organized to some extent, the unions have made no excessive demands. There is plenty of labor which is cheaper than many other places in the world. The people as a whole are quite apt at learning processes and techniques and make efficient workmen.

It is to be hoped that any policy adopted by the government will not be as restrictive as some of the reports early last year would indicate. At that time the Oil Commission had formulated a tentative outline of policy which left much to be desired considering the fact that oil in commercial quantities is yet to be discovered anywhere in the republic. It had been indicated that concessionaires might be expected to meet some fairly stiff conditions, including such items as a guaranteed government income of a substantial amount to be paid whether or not holders of concession contracts had found oil. Proposals at that time also limited the number of exploratory parties and the amount of equipment for drilling exploratory wells. Limits were also to be placed on the percentage of requested acreage which would be granted to any one company.

However, these preliminary proposals were all made prior to the survey of the world oil industry.

Minerals State-Owned

In any case, governmental authorities will have the final say in any development of oil or gas. According to the Regalian Doctrine, recognized during the Spanish Regime, all minerals belong to the state, and only the state can dispose of them in any way. This has been recognized by the Supreme Court and embodied in the constitution, and includes petroleum and natural gas. Actually, the private ownership of lands in the republic is well established as regards surface and other rights. As is the case in the U. S., there are still some lands recognized as public domain and not covered by private titles.

It is fairly certain that a definite attempt will be made to formulate a law acceptable to public opinion and yet allowing outside operators to develop oil and gas resources. Officials realize that development of such resources is to the best interests of the nation if it is to become industrialized to a point where it can compete economically in the world, and no better way is known to exist than to make possible the operation of companies which have the experience, organization and financial stability to undertake such large-scale ventures.

Golden Spike Area Tests Show High Pay Prospects

Attention of Alberta operators remains focused on the Golden Spike area where Imperial Oil Company's Schoepp 1 is still coring in saturated pay after having already cut a full 231 feet of the formation. This well, situated about four miles westerly from the Woodbend field and northwest of the Leduc field, is located on another coral reef prospect apparently separated from both the Woodbend and Leduc fields. The top of the pay in Schoepp 1 was picked up below the water level of the D-3 zone to which it corresponds. The operators have been coring at the rate of ten feet daily, taking a ten-foot core each night and making a drill stem test in daytime. The most recent test was after pulling a core from 5593 feet, and showed 5080 feet of clean oil and a blow of gas estimated at 167,000 cubic feet daily. Another core has now been taken and operators were preparing for the next drill stem test at latest report.

The pay section already cored and tested amounts to more than six times the amount of oil-bearing formation found in the famous Leduc field, and is already half again as much as was found in the discovery well at Redwater field. This is by far the thickest pay section ever found in Canada, and will serve as further incentive to active exploration.

With Help From the USSR

Roumanian Production Rises

A RISE of about 5 percent has been reported in Roumanian crude production for 1948 over 1947, according to reports seeping through the veil of secrecy with which Roumania is covering its petroleum activities. Roumania production for 1948 is estimated at somewhat more than 30 million barrels as against 28,772,000 for 1947.

In June, 1948, Roumania nationalized its oil industry and clamped down censorship on all industry statistics. The only statistical publication in Roumania covering the petroleum industry, *Moniteur du Petrole Roumanin,* was discontinued, and the Association of Roumanian Oil Industrialists, a statistics-supplying agency, was dissolved.

At the same time Russia began applying stepped-up pressure for realization of the Roumanian petroleum program. Under Russian prompting, the Communist-dominated Roumanian government set a crude production goal of 33 million barrels for 1948, and it is likely that the Roumanian government will claim this figure actually achieved. It is known that total Roumanian crude output in April, 1948, reached a high of 83,200 barrels a day, as against a daily average of 78,600 barrels for January, 1948. The Roumanian government claimed sharp production increases after nationalization in June, 1948, but has not given figures to support this claim.

Roumania's cumulative production through the year 1948 is put at 1,202,506,000 barrels.

During 1948 a reported 1,094,000 feet of hole were drilled as against the government's program calling for 1,115,500 feet. The 1948 footage is roughly double that of 1947. The Roumanian government claimed that after nationalization the larger oil companies exceeded the drilling program by more than 150 percent, but this claim is discounted among observers in this country.

The number of wells drilled in Roumania during 1948 is still a closely-guarded secret, but the nationalization program called for the drilling of 210 wells, of which 60 were to be wildcats. This represents more than three times the number of wells drilled in 1947, and it is considered doubtful that the goal was even approximated.

About 40 percent of Roumania's oil is now being used inside the country, and about 60 percent is being exported to Russia and other Soviet Union satellites. It is known that in 1947 about 95 percent (or 14,066,000 barrels) of total exports went to Russia as reparations.

The Roumanian oil industry has been reorganized under two regional "centers," one controlling the Ploesti fields, known as the Muntenia Center, and the other controlling the Moldova fields, northeast of Ploesti, with headquarters at Moinosti. These so-called "centers" are in effect administrative setups programming and directing production, drilling, transportation and marketing of Roumania's oil.

In addition to the "center" control system, the Sovompetrol group operates outside the system. Sovompetrol is a joint body, one-half controlled by Russia and one-half by the Roumanian government, but wholly dominated by the Soviet Union. While the operations of the former Shell company, Astra Romana; and those of the former Standard Oil Company (N. J.) subsidiary, Romana Americana, are both now dictated by the "center" control system, the Sovrompetrol activities are not so controlled.

With nationalization in Roumania, the former private companies and their managements have been placed at the mercy of the Roumanian government. Prominent petroleum industry leaders were arrested and charged with sabotage, or were forced to flee the country. The nationalization was in effect confiscation, since no indemnity was made the British or American operators.

The U. S. government, however, along with the British and other interests, has not recognized the expropriation or the legality of the nationalization law, and on September 7, 1948, "reserved all rights on behalf of its nationals with respect to the seizure of their properties by the Roumanian government, and intends to hold the Roumanian government responsible for the return of the properties or prompt payment of adequate and effective compensation therefor."

After the seizure of the industry in Roumania, the U. S. Department of Commerce held up delivery on an $11 million oil country goods order for Roumania. About $1.5 million of the order, however, had been shipped. Export licenses were denied the rest.

As a result of the failure to get material and equipment, especially from the U. S., Roumanian refineries and other installations are deteriorating rapidly, it is known.

Kirkuk-Tripoli 16-Inch Line Advanced Well Into Syria

Iraq Petroleum Company's 16-inch pipe line from Kirkuk to Tripoli, the northern leg of the dual system designed to move additional amounts of crude from that field to ports at Haifa and at Tripoli, has crossed the border of Iraq into Syria. According to reports from the Middle East, the line crossed the border late in November, and recently was 65 miles into Syria, with construction proceeding at the rate of approximately two miles a day. The 16-inch line is scheduled for completion during the latter part of this year, and was designed to move 90,000 barrels daily. This is the same capacity as that of both legs of the older 12-inch lines combined.

The southern leg of the 16-inch system has been halted for nearly a year only a few miles short of its objective at Haifa. Despite the fact that movement of crude from Iraq has been sharply curtailed during the latter part of the year by suspension of operation on the southern leg of the existing line, Iraq Petroleum Company has been extremely busy on exploratory work throughout the nation, and the results of geological and geophysical work indicate that wildcat drilling sites will keep the operators busy for some time to come.

Hungary's Production Continues Decline

HUNGARY'S petroleum production continued to decline in 1948, totaling 3,580,000 barrels as against 4,330,430 for 1947, a drop of about 17 percent. Since Hungary's seizure of the American properties last September, Budapest has suppressed all information on the country's oil program, but company figures for the first nine months of 1948 plus reliable estimates of crude output for the last three months indicate the following production totals for the chief Hungarian fields in 1948:

Budafapuszta	1,097,000 bbls.
Lovaszi	2,146,000 bbls.
Hahot	337,000 bbls.
Total	3,580,000 bbls.

This figure accounts for all of Hungary's crude production except an insignificant fraction of the total represented by Hungarian government operations in the Bukkszek field. A fifth field, the Ujfalu, is still shut in.

During 1948 four new wells were drilled in the Budafapuszta area and nine in the Lovaszi field. Six others were drilled in the Hahot area, three at Vetym, east of Lovaszi; one test well at Salomvar, another at Nadasd, and two on the Inke structure near the Yugoslavian border. All these were dry holes except one well off the Hahot structure which flowed about 35 barrels a day on initial tests. In addition, one gas well was discovered at Hahot-Ederics, testing 5 million cubic feet of wet gas per day.

Exploration work continued in Hungary throughout 1948. A gravity meter party worked the Budafapuszta and Hahot structures and a torsion balance crew was at work in the southwest part of the country.

Industry observers are agreed that a declining production is in prospect for all Hungarian fields due to the inefficient operating rates ordered by Russian officials. Hungary has seven rigs in its field at present, but most of these are in deteriorating condition and no new equipment is expected. Hungarian industry representatives are known to have asked Russia for some oil field equipment, but Moscow's policy is to step up production without contributing to the Hungarian industry.

The American interests operating in Hungary were confiscated in September, 1948. The properties seized included all those of the Standard Oil Company (N. J.) subsidiary, Magyar Amerikai Olajipari Resvenytarsasag (better known as MAORT). The Hungarian government charged sabotage by the American operators, and extorted false confessions from the American managers, Paul Ruedemann and G. A. Bannantine, both of whom were then deported from Hungary.

Charges Rejected

On November 30, 1948, the American legation in Budapest advised the Hungarian government that the U. S. viewed the property seizure as "wholly arbitrary and unwarranted," and rejected as false and malicious the charges of sabotage. Standard Oil Company recently issued a book containing a full account of the Hungarian case, showing that no acts of sabotage had ever been committed, that from 1937 to 1948 Hungary received free of charge under the contract terms 6 million barrels of oil and also 6 million dollars in royalty, taxes and charges, while MAORT's stockholders received only $206,000 in dividends.

Between 1937 and December, 1941, MAORT produced 6,595,862 barrels of crude. Production increased from 288,423 barrels in 1938 to 3,258,977 barrels in 1941. When the U. S. entered World War II, MAORT was taken over by the Hungarian government and every trace of American management was eliminated. MAORT-owned wells produced 5,117,155 barrels in 1942; and 6,204,065 in 1944. In spite of the Germans' effort to squeeze every drop of oil from the wells, there was a natural decline in the productivity of the Hungarian fields by more than 200,000 barrels between 1943 and 1944, together with damage caused by forced withdrawal of crude with consequent waste of gas and gas pressure.

When the Hungarian Communists took over the MAORT properties last year, non-industry political figures were made dictators of operations. The Oil Commissar in the Hungarian Ministry of Industries, for instance, ordered a crude output of 40,000 tons for June, 1948, an amount beyond the capacity of the fields.

According to recommendation of the secretariat of the Hungarian Supreme Economic Council, July 9, 1947, crude production should be reduced about 10 percent in the interests of efficiency, but experts of the Ministry for Industries stated that a 16 percent cutback was necessary. If such a reduction were not effected, the experts said, the following consequences would result:

1. About 50 percent of crude resources of Hungary would not be usable.
2. That would lead to a consequent decline of 1700 million forints in Hungary's tax revenues in the next 15 years.
3. The excessive production policy would force Hungary to become an importer of crude 12 years earlier than otherwise would be the case.

Immediate Operations for Neutral Zone Announced

J. Paul Getty of Pacific Western Oil Corporation announced that his company will start immediately operations in the Kuwait Neutral Zone territory in which it recently acquired a one-half interest. However, it is likely that actual drilling will have to await an operating agreement between Pacific Western, which holds the concession on the undivided one-half interest in the zone held by Saudi Arabia, and American Independent Oil Company, which holds a concession on Kuwait's one-half interest. Although the principals have not revealed what form this operating agreement might take, it is possible that a separate operating company may be set up.

Getty stated that among other provisions of his company's concession contract with Ibn Saud is one requiring erection of a refinery "similar in size to some of the smaller refineries now operating in the Middle East."

Upper Po Valley Exploration May Extend Into Lugo Area

The Societa Idrocarburi Nazionali of Florence, has made application to the Italian Ministry for Industry and Commerce for a permit to extend its operations in the Upper Po Valley to include a large zone in the district of Lugo between Bologna and Ravenna, where it would like to continue exploratory work.

Since the summer of 1946 this company has been engaged in exploration in the area northwest of Lugo, but the new territory covered by the application would extend the area being surveyed to the province of Forli, and would bring in an additional 42,000 acres. Previously the company had been limited to approximately one-half that amount. Granting of the acreage asked under the new application would bring the holdings of the company to 66,600 acres. These operations are part of the program of prospecting for oil in the Po Valley and the eastern part of the Gothic Line.

In recent weeks some seismic geophysical research work has been carried out in the Consandolo and in the Comacchio districts near the mouth of the Po River by a Swiss company, Compagnie de Prospection Electrique Schlumberger. The work of this company may be extended into the Imola district in the event the permit asked by Azienda Idrocarguri Nazionali is granted by the Ministry.

Meanwhile the Societa Anonima Raffineria Padana Olii Minerali, a company formed by the Fiat company and Caltex interests, has indicated that while the company will build the new refinery previously reported as in prospect for the Trecate area, and will build the Vado-Trecate pipe line, another subsidiary company is to have charge of marketing and distribution of products, which will include high-octane fuel. At the same time representatives of the company said they had no definite plans for the building of links with Switzerland from the refinery through the use of inland waterways. It was confirmed, however, that plans had been broached by Swiss interests who were investigating the possibilities of using part of the Vado-Ligure-Trecate pipe line for moving in oil and refined products through Italian ports.

The subsidiary of the SARPOM is to handle distribution plans to establish about 1000 filling stations on main Italian roads. Recently there has been a suggestion advanced that because of the shortage of funds from the government for building roads, it might be possible to get foreign oil companies operating in Italy to finance the road construction program in return for exclusive distribution service along the roads built with their support.

First Australian Deep Test Is Scheduled for This Year

The Shell (Queensland) Development Company is scheduled to get started on its first really deep test in Australia by early in the second half of this year. A heavy drilling rig is to be used, since it is possible that the well may be taken to 10,000 feet or more, and a large part of the equipment has already arrived in Brisbane. From there it will be moved to the selected drilling site in the Warrinilla area about 105 miles north of Roma.

The company has been active in Australia for eight years and has already spent a reported $4 million in preliminary work. Structure holes have been drilled, including ten in the Rolleston area and 18 in the Warrinilla district, and reports from Australia indicate the company is prepared to spend another $3½ million in these two areas alone. The earlier work started with aerial surveys made before World War II and has continued with geological work which was later supplemented with the core drilling program.

In addition to Shell's operations a number of smaller companies are collaborating in some intensive survey work in the Roma district where activity was first stimulated shortly after the turn of the century when natural gas showings were found while drilling for artesian water. The gas found at that time was sufficient for use in the town of Roma, but has not been re-established since the plant and well were destroyed by fire shortly after operations had been started.

The Australian government's Bureau of Mineral Resources is making a magnetic and gravity study of the Roma area and some time this year expects to complete a seismic survey which should be invaluable for use in correlating subsurface information gathered from previously drilled shallow wells.

The Bureau of Mineral Resources is also carrying out work elsewhere in Australia which will serve as useful basic information for more detailed petroleum exploration. It has had a party working in the Kimberleys for more than a year, while Vacuum Oil Company Pty., Ltd., and Zinc Corporation, Ltd., have done active field work in the same area for the past two years. A detailed study has been made by the Bureau of the Nerrima structure where the Freney Kimberley Oil Company drilled a well to 4270 feet before the war. It is possible this well may be deepened.

Another interesting area is the Northwest Basin which extends from below Shark Bay to above Exmouth Gulf about midway up the West Australian coast. In this area the Australian Motorists Petrol Company, Ltd., has taken up a large area in conjunction with two California companies and several American geologists have started field work but so far no wells have been drilled for oil. A few deep water wells have been drilled but none of them have shown any indication of oil.

In the area near Callide, central Queensland, a proposal has been outlined for producing petroleum products from black coal, extensive deposits of which exist near the surface. It has been estimated that 100 gallons of oil per ton of coal could be produced, but the firm making the proposal has stipulated that the government would have to exempt the project from taxation for a period of seven years. The general area is described as one of the larger coal-bearing basins of the world.

Kuwait Reserves

Crude reserves in Kuwait considered proved at the end of 1947, applicable to the half-interest owned by Gulf Oil Corporation, were estimated at 5,138,000,000 barrels. This would indicate a total proved reserve for Kuwait of 10,276,000,000 barrels, all of which is localized in the Burghan field. This figure was reported by Gulf to the Securities Exchange Commission early in 1948.

Reconstruction Remains Slow In Burma Oil Producing Areas

Rehabilitation of oil-producing areas in Burma has been hampered considerably since the end of the war, and although expenditures amounting to $32 million by the Burmah Oil Company had begun to show results in the form of reconstruction of facilities, this work has now come to a standstill. A late report indicates the operators are evacuating the wives and children from the central oil field areas, and it may eventually be necessary to remove all British personnel from the area.

Burmah Oil Company, Indo-Burmah Petroleum Company, and British-Burma Petroleum Company chartered a plane from India to move about 70 women and children to Rangoon, and it was possible they would be taken on to England. For the time being the men actually working in the fields have remained on the job, but these may be evacuated later unless conditions improve. Since the beginning of the attempt to rehabilitate the fields the work has been delayed, not only by difficulties in securing delivery of needed equipment and supplies, but by country-wide civil disturbances. Now full-scale insurrection has brought operations to a standstill. Fields in all districts except the central areas around Chauk and Yenanyaung are in the hands of Communists or tribesmen.

Early in 1948 some progress had been made in reconditioning wells not too badly demolished during the war, but there has been no actual drilling started to date. Some work was also done on repairing pipe lines from the producing fields to the site of the demolished refineries near Rangoon. Now the outbreak of civil war has made it impossible to continue work on the pipe lines, and work in the fields has been hindered also.

Since no refining facilities of any great capacity are available, production has been limited to what crude can be processed through the small field topping plants. This is estimated at 300,000 barrels, most of which came from wells in the Chauk field, with some small amounts from the Yenangyaung and other minor fields, and some from surreptitious working of wells in smaller outlying fields.

An attempt was made to resume exploratory activity during the year and it was possible to do some geological work to the northeast of the Chauk fields in the area around Myingyan, but this work has also been halted by the unsettled conditions.

Meanwhile the government of Burma has proposed a partnership with financial aid to the Burmah Oil Company with the announced purpose of helping reconstruct the national oil industry. Negotiations along this line would hinge on the financial aspects of the reconstruction program. It seems apparent that in view of the government's own monetary troubles any financial arrangements would probably depend on securing a foreign loan.

RICHARDSON ADDRESSES NOMADS—**Nearly 60 members and guests at the March meeting of the Houston Chapter of Nomads heard an account by I. D. (Rich) Richardson of his experiences during the Japanese invasion and occupation of the Philippines. Richardson commanded one of the "P.T." boats made famous by their exploits during the early phases of the war with Japan, and upon which General MacArthur and members of his staff were removed at the last moment. Following destruction of the last P.T. boat and the fall of Corregidor he commanded the guerilla forces on Leyte and neighboring islands until the time of MacArthur's successful landing on Leyte in the final stages of the war.**

Guests in the photograph, left to right, are John T. Warde, Shell Caribbean Oil Company, Venezuela; Jack Hines, Creole Petroleum Corporation, Venezuela; Donald Redman, Standard Oil Company of California, Calgary, Canada; Lieutenant Commander Richardson; James Maughan and R. R. Dutka, both of Standard of California, Calgary; Paul Hubbard, Gulf Oil Corporation; H. Houghton, foreign drilling contractor, New Orleans.

Further Activity in Bahamas Drilling Appears Doubtful

Exploration work is at a virtual standstill in the Bahama Islands and prospects are dim for carrying through the originally projected drilling program. Companies with concessions in the islands held a conference in July but were unable to agree on procedure and cost participation for a joint wildcat. Since that time interest has lagged, and Shell has even relinquished its rights in the area.

Other companies interested in the islands are Standard Oil Company of Bahamas (Standard Oil Company [N. J.]), Anglo-Bahamian Petroleum Company (Anglo-Iranian Oil Company), Bahamas Exploration Company (Gulf Oil Corporation), and Bahamas Oil Company (The Superior Oil Company). Other smaller groups holding rights in the area are British Bahamian Oil Development Company, Bahamas Mining Company, Ltd., and Nassau Oil Mining Company.

The companies completed a joint aerial magnetometer survey of the water area more than a year ago, and followed that up with other exploration activities. Bahamas Oil Company displayed most interest and continued gravitymeter work in northwest Andros Island and other locations. However, the companies could not agree on the share of participating expense in the drilling program, and at the present time no concrete plans exist for the drilling of a second well. One well was drilled by Superior on Andros Island and it is known that some of the other companies were dissatisfied with this site.

Meanwhile, the original three-year exploration concessions were extended another two years so that the need will not arise until early next year to convert the exploration licenses into prospecting licenses. Since this conversion, however, requires an earnest of planned work that would be undertaken by the concessionaires, it is believed that most of the current licenses will be allowed to lapse at expiration date.

Interest in the Bahamas as a possible source for oil waned immediately with the change in the supply situation and with the negative results so far recorded for Florida. The American companies, though, would still be willing to undertake some joint operation if costs could be kept down and apportioned satisfactorily. One difficulty is the inability of the British companies to use dollars in payment.

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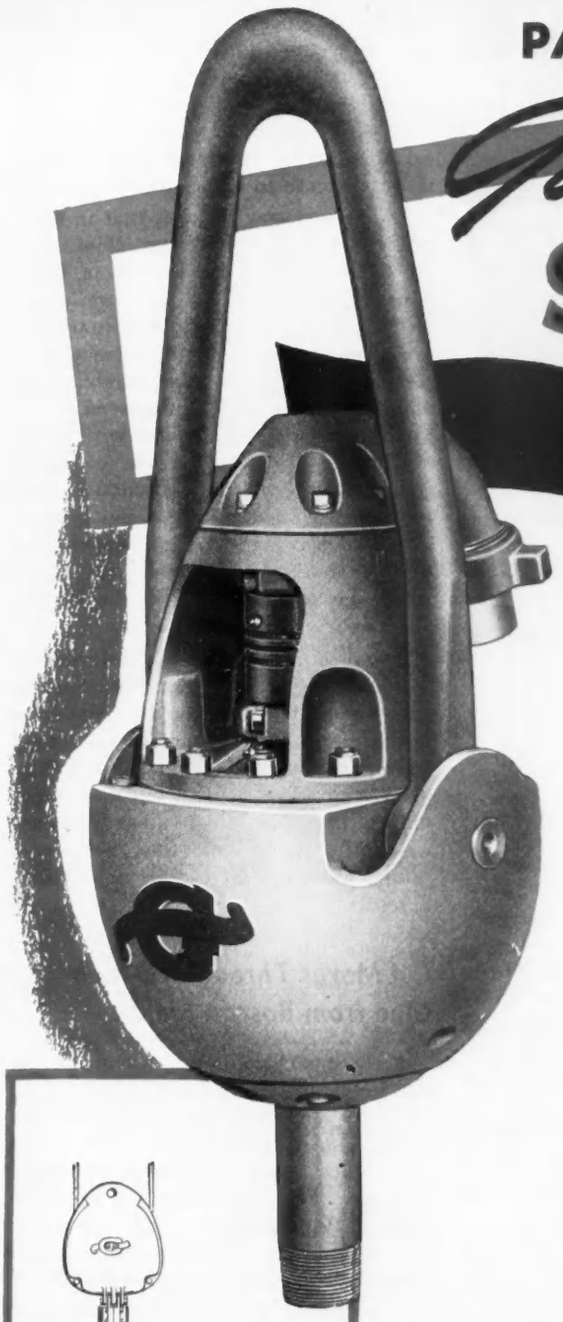

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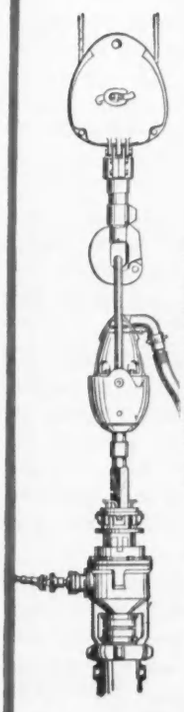

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Doctors attending medical congress grouped in front of company hospital, Bahrein Island, November, 1948.

Oil Operators, Doctors Unite To Aid Middle East Health

Oil operators in all of the Middle East areas have expressed interest in the first concerted move toward a systematized program to study and improve health conditions. Near the end of the year a meeting on Bahrein Island resulted in the formation of the Persian Gulf Medical Society, which has adopted specific and far-seeing aims.

Anyone interested in oil operations in the Middle East area is aware of the many problems connected with exploration, drilling, transportation, refining and recruitment of trained and untrained staff members and labor. The latter includes thousands of local inhabitants who are employed on these vast projects. Many people are aware of the time and effort which has gone into programs of training local employes to improve their skills and prepare them for greater responsibilities, meanwhile giving them gainful employment and a greatly improved economic situation.

A far fewer number of people have given more than a passing thought to the problems posed along with these other responsibilities. Chief among these is caring for the health of all employes in these areas where endemic diseases are so prevalent. As one of the early oil operators in the Persian Gulf area, Bahrein Petroleum Company has been studying sanitary and other measures of broad scope with a view to minimizing illnesses due to tropical diseases and infections with resultant fevers.

Since malaria and other fevers were the most serious from the point of view of man-days of work lost, a full-scale campaign for malaria control and suppression on Bahrein Island was begun in 1946 under the direction of the Medical Department of the Entomological and Sanitary Engineers' staff, especially chosen for this work. This team attacked the problem from all angles, and has compiled an amazing record in reducing the incidence of malaria and consequently the time lost among personnel during the past two years.

Every modern technique, including many in use in other parts of the world, was used to accomplish this result, and its success is judged by the fact that loss of time from work due to malaria decreased between 60 and 75 percent from 1946 to 1947, and reports during 1948 indicate that with constant effort, including education, malaria can be reduced to a minor cause of illness.

The success of the island's program attracted attention of others in the Middle East confronted with the same problem. Therefore, when the Bahrein Medical Society sent out an invitation to attend a medical congress late in 1948, 36 doctors attended the meeting. It was the first meeting of its kind in the area and was of an experimental nature with three principal objectives. It was desired primarily to exchange ideas held by European, American and Indian doctors as to the underlying causes behind, diagnosis and treatment of diseases endemic in the area. Second, it was thought desirable to determine the interest and the number of doctors who would attend such a meeting, with a view to forming a more closely knit organization. Third, it was believed that a meeting of this kind would do much to stimulate medical thinking in a section where there is little access to large medical centers.

Of interest was the fact that in addition to Dr. Robert J. Biggar, chief medical officer of Bahrein Petroleum Company and his staff, there were representatives from the civilian, military and governmental fields of the medical profession from Kuwait, Saudi Arabia, Iran, and others. The speakers covered a wide range of problems connected with health conditions throughout these countries, followed by round-table discussions, and it was clear that all were much interested in drawing upon the experiences of one another in dealing with health conditions and problems in the Persian Gulf area.

The meeting resulted in the formation of the Persian Gulf Medical Society, with committees appointed to study the problems of the area, and subcommittees to report on various phases for later correlation. The society will meet semi-annually, and it is likely that great improvement in the health of the peoples of the Middle East can be expected as a result.

Oil Moves Through 18-Inch Line from Boscan Field

Richmond Exploration Company has started deliveries from its Boscan field, Western Venezuela, to storage on Lake Maracaibo through its new 18-inch pipe line. Since reaching decision to develop this new field, the company has completed 23 productive wells, not all of which are on actual production since some are waiting for installation of pumping equipment and gathering facilities.

Estimated aggregate potential of the field is now about 12,000 barrels daily, all of which is heavy oil suitable for manufacture of asphalt and heavy fuel oils.

With the drop in demand for the heavier crudes, the company is preparing to concentrate more attention on the new Ensenada field, situated between Boscan-Albaricos field and the lake where the discovery well produced 39.9-gravity oil during completion tests from a deeper horizon.

In all, eight drilling rigs are being operated in various parts of the western concession area, including several exploratory wells. The latter are being drilled primarily in search of Cretaceous limestone production such as occurs at La Paz and Mara fields to the north.

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American Independent Closes Syrian Oil Concession Deal

The Syrian government has agreed to grant a 70-year oil concession to an independent American operator, Syrian-born James W. Menhall of Benton, Ill.

The deal, which covers approximately 22,100 square miles, involves no cash down payment by the Arab concessionaire, but has stipulations requiring more intensive exploratory drilling than involved in previous concessions. It is the largest area negotiated for in several years. In addition to grant of development rights, the Syrian government has given guarantees to Menhall that the five new pipe lines planned by other companies to cross Syrian territory will be required to make available up to 30 percent of their capacity as common carriers for Syrian oil, if he obtains production convenient to such lines.

Royalty called for in the concession is the standard American one-eighth of production, with option for the government to accept the market value or a minimum of 34 cents per barrel gross production, whichever may be larger.

Recent offerings by other American interests for oil rights in the Middle East have involved royalties from 34 to 55 cents per barrel, with cash down payments as high as $10,000 per square mile, An all-time record was set in the 2200 square mile Kuwait Neutral Zone, where negotiations with the two Arab rulers for their respective 50 percent interests culminated in an aggregate down payment by the oil companies involved totaling $86,363 per square mile.

The territories granted to Menhall are all lands south of the parallel through Damascus plus a large portion of the Djezireh region, the latter lying to the west of Iraq Petroleum Company's line of oil fields from Qaiyarah to Ain Zalah. The southern sector has been considered unfavorable for oil because it includes the volcanic Djebel Druse, but this 6000 square miles contains several sedimentary deposits. (On one of these the Germans, who made the initial oil discoveries in Iraq, were preparing to drill a wildcat when they lost World War 1.) Almost all the northern area has been under control of the IPC's subsidiary, Syria Petroleum Company, whose concession calls for it to have surrendered one-third on February 5. Since acquiring its original 47,000-square mile concession in March, 1938, the SPC has drilled six wells. In addition to the 15,700 square miles of Djezireh formerly held by SPC and now being turned over to Menhall as the major part of his concession, a further 400 square miles in the vicinity of Djebel 'Abd El-Aziz withheld from SPC are expected to be included in the Menhall concession, subject to clarification of its legal status. Under the terms of his agreement, Menhall is to keep not less than three wildcat rigs operating continuously, of which one will be in the southern portion of his concession.

Menhall, owner of the J. W. Menhall Drilling Company of Benton, Ill., currently has about 80 wells and 1300 barrels per day production in Illinois, Kentucky and Louisiana. He is registering The Syrian-American Oil & Gas Company S.A.S. in Damascus to operate the concession, and its $100 million authorized capital is to be opened for simultaneous private subscription on an equitable basis with both U.S. and Syrian participants. He already has six rigs available for the project, the first of which is being prepared for immediate shipment to Syria.

for Speedy . . . Low-Cost Cleaning of Rigs, Diesels, Rotary Tables use

Oakite Steam-Detergent Cleaning

FOR speedy, low-cost cleaning of rotary tables, mud hogs, crown blocks, drilling-rigs, drilling-rig Diesels, pipe lines, etc., try Oakite Steam-Detergent Cleaning. In fact try it on the toughest cleaning or paint-stripping job that comes along.

By combining the vigorous detergent action of a specialized Oakite material with mechanical force and heat, Oakite Steam-Detergent Cleaning literally blasts dirt away. Grease and muck disappear almost like magic. You'll particularly like the way you can clean out hard-to-get-at recessed areas.

Oakite "88" Digest contains details. Shows how to speed up and cut costs on other maintenance cleaning jobs with Oakite Steam-Detergent Cleaning. Copy mailed promptly on request. No obligation.

OAKITE PRODUCTS, INC., 37 Thames St., NEW YORK 6, N. Y.
Technical Service Representatives in Principal Cities of U. S. & Canada

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PETROLEUM SERVICE DIVISION

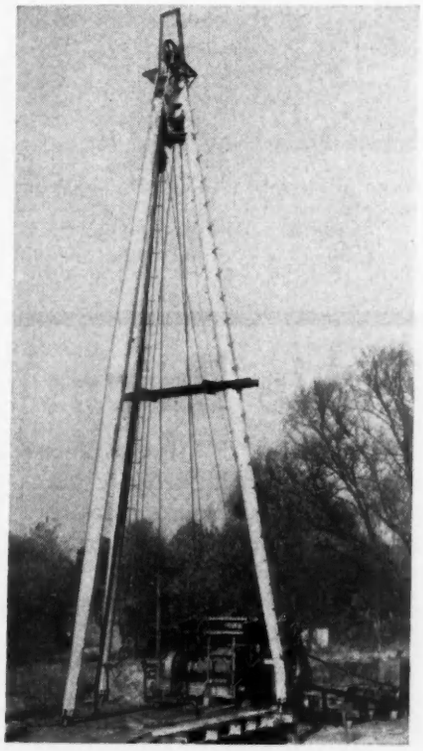
NEW AND IMPROVED Equipment SUPPLEMENTING COMPOSITE CATALOG

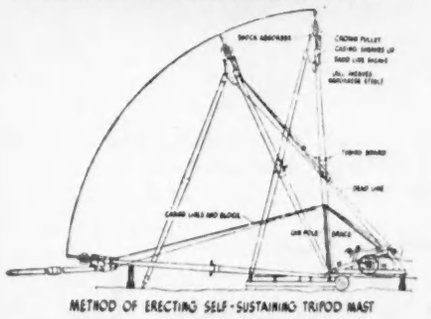
New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

104—Spudder

This item supplements Young Engine Corporation data as shown on page 4416 of Composite Catalog.

A spudder in a skid-type frame is mounted on a five-inch tubular rear axle equipped with four 11.00 x 20 pneumatic





METHOD OF ERECTING SELF-SUSTAINING TRIPOD MAST

tires on an 82-inch track. Air brakes are provided. If desired, the wheels can be removed for transporting the spudder on a carryall and, when necessary, the axle may also be removed for skidding the spudder into place with a tractor. The weight of the spudder is 36,000 pounds. Capable of drilling 3000 to 7000 feet or deeper, it can be driven by any gas or Diesel drilling engine of sufficient power for the desired well depth.

The new steel mast is of the self-sustaining tripod type. It consists of three boom-type legs which are anchored to the structural steel base and require no guy lines. The legs are of large diameter at the middle, tapering to a smaller diameter at both ends. According to the specifications, a built-in shock absorber in the mast head carries a manganese crown pulley. Three manganese casing sheaves and the sand line sheave are assembled in the mast head. There are no girts, braces, or guy lines to interfere with pulling in the stem, casing or tubing.

The lined drawing shows the tripod mast assembly on the ground, ready to be raised. Before doing so, the drilling cable and sand line are strung up. The casing line with blocks and dead line are placed over the gin pole as shown. The mast is then raised with the bull wheels. The weight of the mast with its structural steel base is approximately 18,000 pounds, with a capacity of 250,000 pounds.

For additional information, write for Bulletin No. 51, Young Engine Corporation, Department WO, 2108 Allen Avenue, S.E., Canton, O., *referring to* WORLD OIL *item* 104.

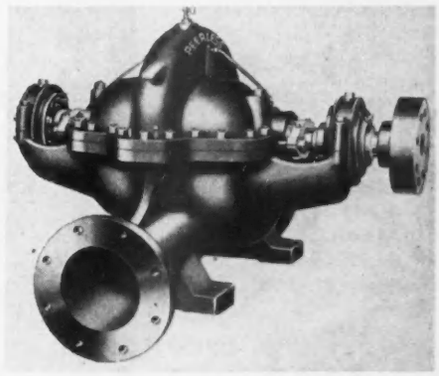
105—Horizontal Pump

This item supplements Peerless Pump Division, Food Machinery and Chemical Corporation data as shown on page 3490 of Composite Catalog.

Characterized by a wide capacity range of up to 60,000 gallons per minute against heads up to 300 feet, an augmented line of horizontal centrifugal pumps, for general purpose pumping of water and alkaline fluids at temperatures up to 300° F., is designated as Peerless Type A. Of single stage, double suction, split case design the pump is available in sizes from 1¼ through 48 inches. All types of drives may be employed, including direct-connected electric motor, diesel, natural gas and gasoline engines, belted drives, steam turbine and combinations of these.

Type A pumps are regularly furnished in cast iron, but may be obtained in steel, bronze or other alloys.

The case of the pump is split at the center line of the shaft, enabling the upper case and rotating element to be inspected or removed without disturbing pump alignment or piping connections. The upper half of the case is provided with water seal pipe to the stuffing boxes, air vents and lifting eyes. Drain plugs are provided in the lower half of the case. Stuffing boxes are wide and deep, each box utilizing from five to six rings of graphited, braided asbestos packing. Impellers are of enclosed double suction design, normally furnished in bronze but available in other materials such as cast iron, stainless steel, monel or other alloys.



Impeller wearing rings, case wearing rings and shaft sleeves are used. Shafts are of rolled carbon steel, machined all over. Grease lubricated ball bearings are provided, with the exception of the 30-inch size and larger, which are equipped with babbitt lined sleeve bearings and ball thrust bearing.

For additional information, write for Bulletin No. B-1300, Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles 31, *referring to* WORLD OIL *item* 105.

106—Diesel Engine

This item supplements Cummins Engine Company, Inc., data as shown on pages 1089-1108 of Composite Catalog.

A supercharged diesel engine for industrial applications is designated as Model HRBIS-600 and develops 225 horsepower at 1800 revolutions per minute.

The engine has a 5⅛-inch bore and a six-inch stroke, with piston displacement of 743 cubic inches. It employs the four-stroke cycle principle of operation. Other mechanical features include standard two-valve heads, continuous groove main bearings, increased flow lubricating system, buttress-type oil pan and flywheel housing, a new lubricating oil cooler and a Roots-type blower.

For additional information write Cummins Engine Company, Inc., Columbus, Ind., *referring to* WORLD OIL *item* 106.

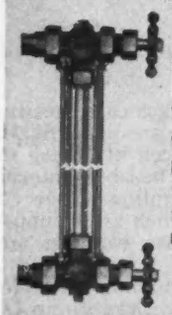
PENBERTHY
Liquid Level GAGES

REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

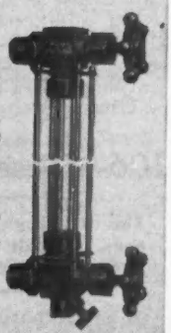


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.



There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

PENBERTHY PRODUCTS INCORPORATED

PENBERTHY INJECTOR CO.

Detroit 2, Mich.

Canadian Plant — Windsor, Ontario

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

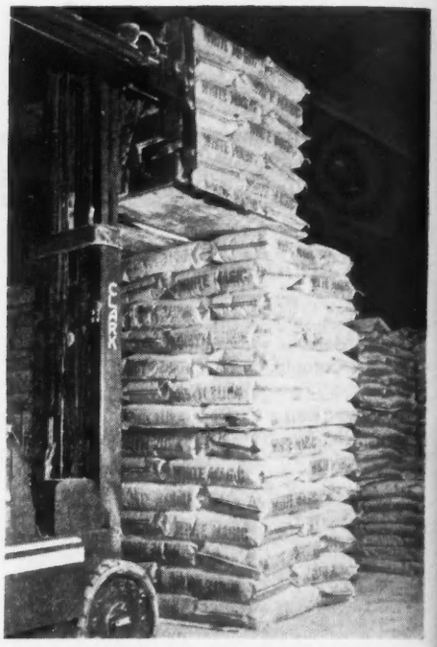
107—Oil Emulsion Mud

This item supplements Oil Base, Inc., data as shown on page 3021 of Composite Catalog.

For top-hole drilling, a new oil-emulsion mud to be known as White Magic produces a low water loss mud capable of being built to any desired weight up to 130 pounds per cubic foot when added to a water-base clay mud with crude or refined oil.

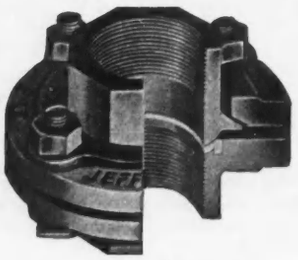
No extra equipment is required with the mud. It may be injected into the pits through a hopper in the normal manner. Drilling need not be interrupted while the emulsion is being made. The oil-emulsion mud gives lubricating qualities to water-base muds. It helps lubricate bit bearings, and reduces drill pipe torque. It is electrically conductive and accurate electric logs may be obtained with normal survey equipment. The mud forms a paper-thin, tough, pliable mud cake that tends to prevent washouts and to keep heaving and hydrous disintegrating shale in place. It is little affected by cement, salt, limestone, gypsum and anhydrite. Control is the same as for conventional water-base muds.

The new mud contains no acids or corrosives and is a soluble white powdered material, packed in 100-pound sacks.



For additional information, write Oil Base, Inc., 130 Oris Street, Compton, Calif., *referring to* WORLD OIL *item* 107.

Jefferson Malleable Unions



STYLE "B"

JEFFERSON Style "B" three-piece flange union is made with brass-to-iron and iron-to-iron seats. Being made of highly refined AIR FURNACE iron, it assures you of lightweight construction, perfect ball joint, and positive seating arrangement, whether or not in alignment.

★ ★ ★

HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	O. W. G.	S.W.P.-550 Deg.
½" thru 4"	2000#	800#	250#
5" and 6"	1200#	500#	250#
8" and 10"	1000#	400#	250#

Malleable iron used in all JEFFERSON unions meets ASTM-4733, Grade 35018—M. T. 53000 Lbs., giving 75%-more elongation 50%-more impact value and is 30%-stronger than cupola malleable iron.

Obtainable through your jobber

Jefferson Union Company, Inc.

691 West 26th St.,
New York 1, New York

71 Gooding St.,
Lockport, New York

31 Fletcher St.,
Lexington, Mass.

TRUCO DIAMOND BITS mean

Irresistible Cutting Power

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue
Detroit 6 • Michigan

WHEEL TRUEING TOOL CO. of CANADA, LTD.

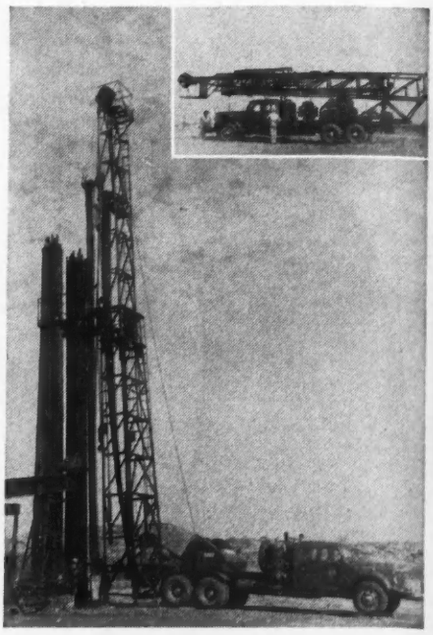
575 Langlois Avenue
Windsor, Ont. • Canada

108—Well Servicing Unit

This item supplements Franks Manufacturing Company data as shown on pages 1333-1368 of Composite Catalog.

Recently developed is a new truck-mounted, truck motor-driven, well servicing unit complete with integrally mounted 64-foot, 60,000-pound, screw-raised telescoping derrick. This derrick is raised from over-the-road position by two large raising screws in from four to seven minutes. Derrick extension is accomplished by a small winch located beneath the truck bed.

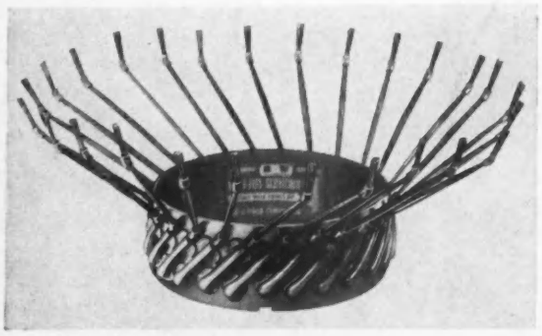
The unit features a movable remote control box that can be placed anywhere within a 25-foot radius of the unit, giving finger-tip control to high and low friction drum clutches, brake, accelerator, starter button and ignition lock.



An air-operated tubing board is folded and unfolded from the derrick by air valve controlled from the ground. This air-operated board has easily made adjustments to allow for various tubing lengths in different wells. The rated capacity of the board is 5000 feet of 2⅞-inch tubing in singles. The monkey basket or rod board is built into the derrick and is equipped with two paramount rod hangers, enabling the crew to handle their rods in doubles on both sides of the derrick, thus getting better weight distribution. The rod transfer is made by a permanently mounted air cylinder which is operated by the derrick man's foot, permitting him to use both hands in transferring the rods from the rod elevator to the hanger. Ratchet type support legs on both truck supports and front derrick legs simplify leveling of the derrick.

The unit has a new winch air brake system which is spring loaded for engagement at all times until disengaged by two heavy-duty air cylinders. In event of an air failure the brake is automatically set and operations cannot proceed until sufficient air pressure is restored.

For additional information write Franks Manufacturing Company, Box 3218, Whittier Station, Tulsa 8, *referring to* WORLD OIL *item* 108.



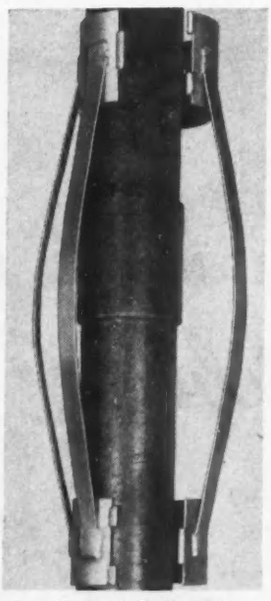
B and W Multiflex Scratcher

Remove Mud Cake, Center the Casing and You'll CUT CEMENTING FAILURES to the Core!

MORE AND MORE OPERATORS are getting better cement jobs the first time, eliminating need for squeeze cementing and saving thousands of cementing dollars with this B and W equipment. Here's how:

MUD CAKE REMOVAL is accomplished with B and W Multi-Flex Scratchers installed on the casing opposite the cementing zone. Strong multiple-wire fingers 5" long combine strength with reversibility . . . are flexible to adapt themselves to hole contour for minimum disturbance of the mud cake while running in . . . insure *complete mud removal* during cementing operations.

CASING CENTERING with B and W Latch-On Centralizers installed either at the rack or rotary table eliminates troublesome channeling, insures better cement bond between casing and formation. Split hinge construction makes installation easy on either collared or external upset casing . . . both straight and spiral types are available to meet all well conditions.



B and W Latch-On Centralizer

If cementing failures are robbing you of profits, plan *now* to use economical B and W equipment on well completions. We'll be glad to send you full details—write us today!

Don't Squeeze! . . . it CAN be avoided

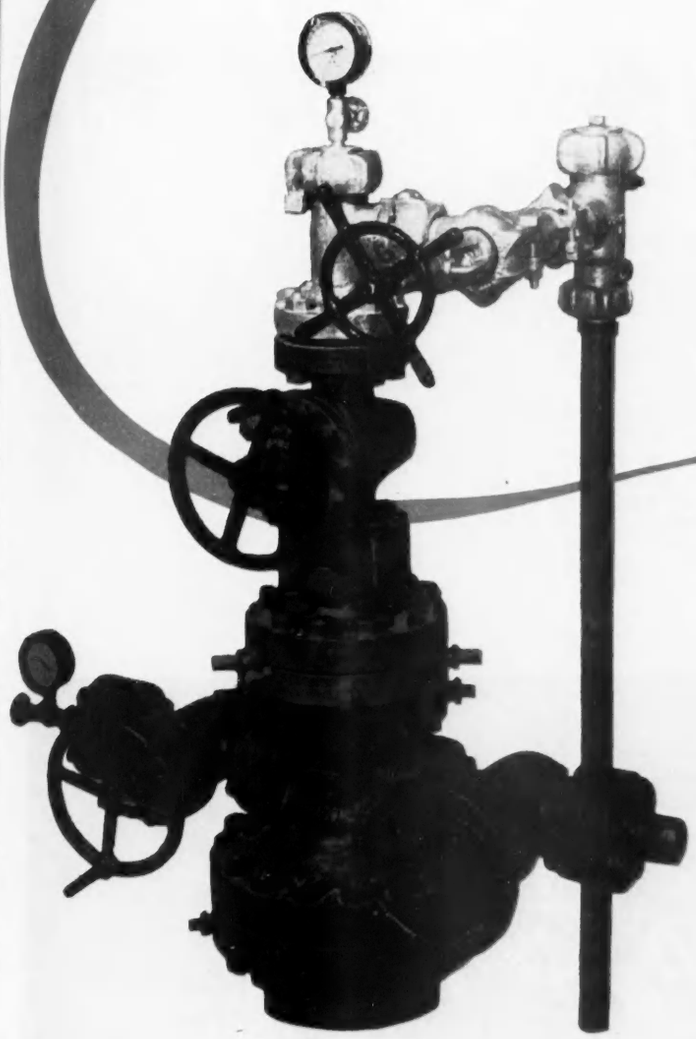
B and W Incorporated

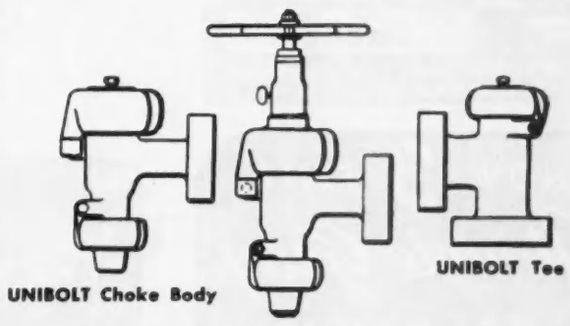
★ Well Completion Specialists ★

305 M & M BLDG., HOUSTON 2, TEXAS • 3545 CEDAR AVE., LONG BEACH 7, CALIF.

For Corrosive As Well As Non-Corrosive Production

UNIBOLT FLOW MANIFOLDS are your best bet!





THREE DISTINCTIVE UNIBOLT FITTINGS Tied Together In A Strong, Light-Weight, Pre-tested Flow Manifold.

For Non-Corrosive Wells

UNIBOLT pre-assembled and tested flow manifolds of carbon steel last indefinitely on non-corrosive wells. They combine all essential fittings required above the master valve of a Christmas tree: Tee or Cross with blanking plug tapped for gauge, Adjustable Wing Valve, and Positive Choke Body with coupling on its outlet for the flow line. All connections in the manifold are UNIBOLT, which means that they are stronger, safer, lighter weight, less bulky, completely interchangeable and more economical. And only UNIBOLT Flow Manifolds utilize Flow-Rated Beans, which assure the exact production of any predetermined quantity of fluid.

For Corrosive Wells

UNIBOLT Flow Manifolds for corrosive wells have all the features of safety, convenience and economy as outlined at left, the only difference being in the steel. UNIBOLT engineers, after long experimentation, have developed a special high chrome alloy, which, when given a carefully controlled heat treatment, produces excellent chemical and physical properties for resisting corrosion. On extremely corrosive wells where ordinary steel fittings required replacement in *forty days*, this special alloy has been in service for *two years* and still shows no signs of corrosion!

THORNHILL-CRAVER COMPANY

HOUSTON, TEXAS

SAFER, FASTER JACKING
• ON RIG SKIDDING
• MACHINE MOVING
• IN CONSTRUCTION
with SIMPLEX Geared Jacks

Designed for heavy duty action, engineered to save time and money on scores of jobs. 25 ton models shown have right and left hand toe lifts, respectively, for paired operation. All furnished with oval hickory lever poles for maximum strength.

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NOW 3 FINE
Jimmie Gray
COMPOUNDS

INSURE
LONGER LIFE FOR
TOOL JOINT THREADS
EXCLUSIVE 500 TON SPECIAL

You can always break the joint when you use Jimmie Gray Compounds! Each one is engineered to do certain specified jobs best!

KANT-GALL TOOL JOINT COMPOUND

Both new compounds have the same dependable quality, the same money-back guarantee as the widely used Jimmie Gray 500 TON Special!

LONG-LIFE DRILL COLLAR COMPOUND

SOLD BY SUPPLY STORES EVERYWHERE

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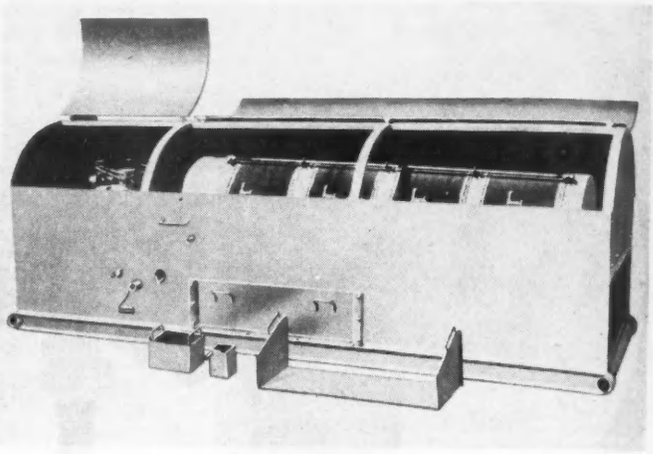
BOX 203 HOUSTON, TEXAS
CHARTER 4-5648

NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

109—Shale Separator

This item supplements Thompson Tool Company data as shown on pages 4122-4125 of Composite Catalog.



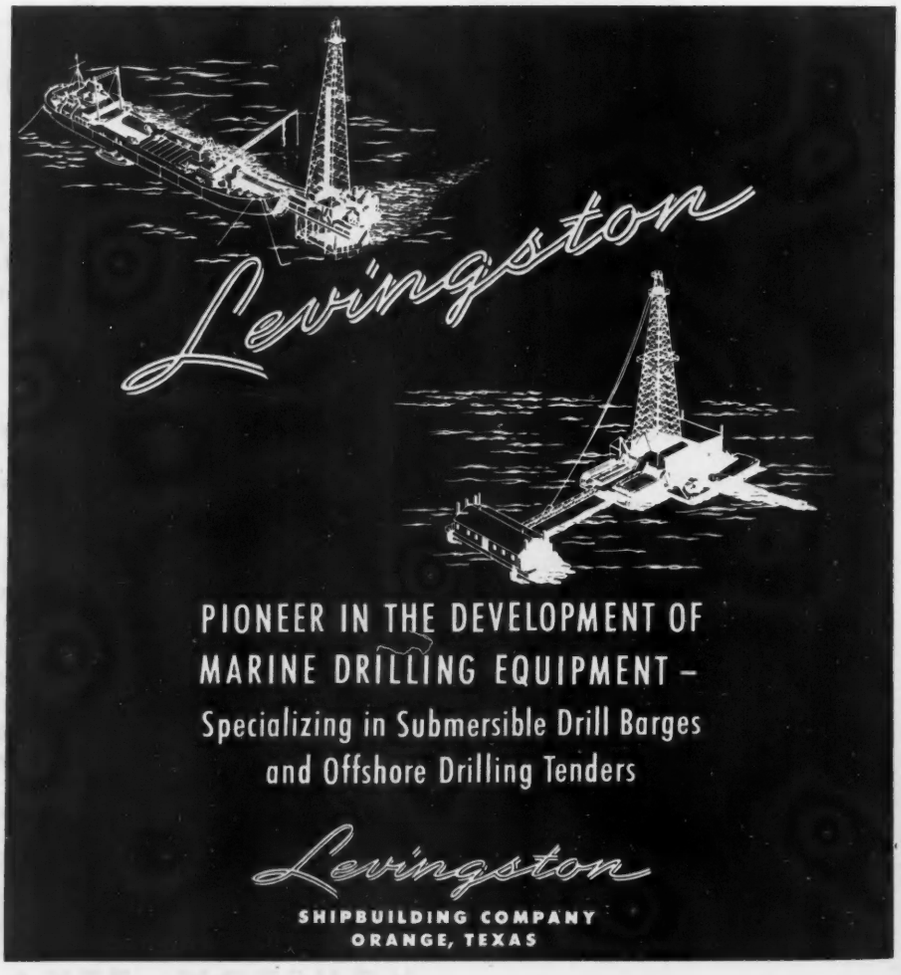
A new type shale separator, now being tested in North Texas fields, is made primarily for deep hole operations but is adaptable to all drilling requirements.

The separator incorporates the use of a three-fourth-horsepower electric motor that performs the dual role of pumping mud from the bottom of the separator to spray the screens on the separator and also turning the screens for proper shale separation and mud recovery.

Power from the paddlewheel can be utilized to turn the screens and the spray pump will keep the screens clean when the attachment is used on standard models. No additional water is necessary as the mud is forced through a jet and the original specifications of the mixture are retained. The new separator controls the mud consistency to any desired standards.

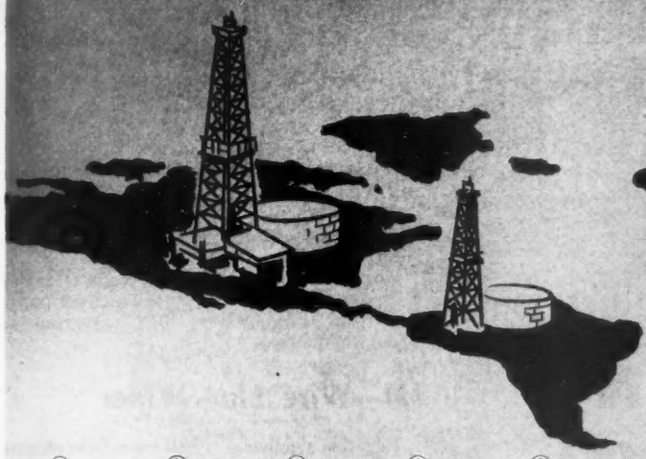
The screens, totaling 35 square feet of space, are interchangeable and give mesh graduations from fine to medium and course. The cover opens up to give access to the enclosed screens.

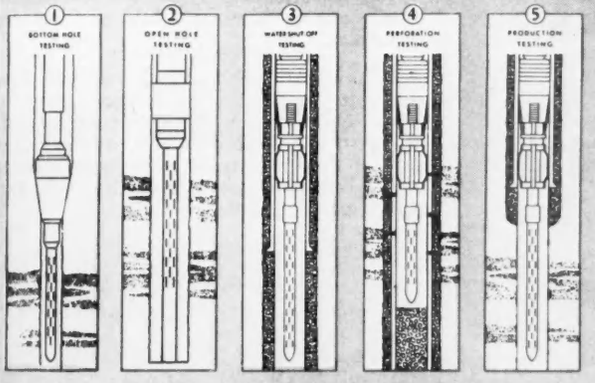
For additional information, write Thompson Tool Company, P. O. Box 357, Iowa Park, Texas, *referring to* WORLD OIL *item* 109.



First choice...

FOR PREVIEWING WELL POTENTIALS





Check these important uses of the JOHNSTON FORMATION TESTER

- Determining the productive possibilities of all zones encountered during the course of drilling. (See Figs. 1 and 2)
- Determining the effectiveness of the water shut-off on cemented casing, whether shoe or squeeze job. (See Fig. 3)
- Determining the effectiveness and productive results of perforating jobs in casing. (See Fig. 4)
- Determining the productivity of a zone in a completed well before landing a liner or oil string, but after the water string is set. (See Fig. 5)
- Determining the productivity increase of an acidizing job.
- Determining the exact location of a fracture or leak in casing.

The JOHNSTON FORMATION TESTER

The Johnston Formation Tester is relied upon by operators throughout the world for determining the productivity possibilities of sands encountered in drilling wells as they are penetrated without the expense of setting casing. Its wide range of applications makes it adaptable to every formation testing job on the lease and provides the ultimate in tester accuracy and safety.

For complete information on the time and money-saving advantages of Johnston Testing Methods and Equipment write for illustrated brochure.

Why set casing before you know?

SHOOT TEST FORMATION AND CASING TESTING JOHNSTON Trademark

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3035 Andrita Street, Los Angeles 41, California
"Servicing California-Permian Basin-Rocky Mountain Areas"

BRANCHES
Bakersfield, Avenal, Sacramento, Ventura, Santa Maria, Cal.; Odessa, San Angelo, Tex.; Casper, Wyo.; Hobbs, N.M.

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NEW EQUIPMENT

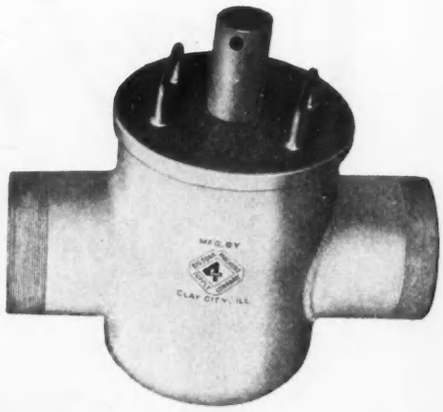
SUPPLEMENTING COMPOSITE CATALOG

110—Suction Strainer

This item supplements Big Four Machine and Supply Company data as shown on pages 624-625 of Composite Catalog.

A new type suction strainer for use on mud pumps, mud lines and similar applications eliminates much of the lost time of drilling contractors in shutting down pumps to clean out leaves, sticks and other foreign matter from slush pits. It can be dismantled, cleaned and reassembled in less than ten minutes.

The strainer is composed of four parts, body, screen, cap and nut. The screen fits over a bolt positioned in the center of the body and is held in place by slots in each side of the strainer. The strainer cap is equipped with hydraulic packing for making positive seal to the body and the nut also has hydraulic packing to seal on the cap. Over-all length of the



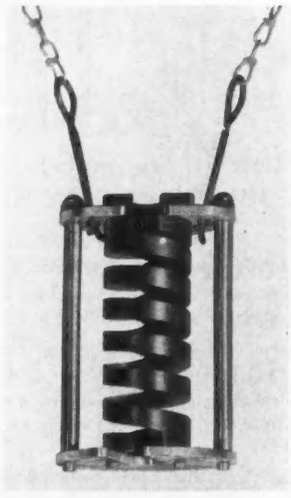
new strainer is approximately 26 inches, and weight is approximately 200 pounds. It is available in 4, 6⅝-, 8⅝- and 10¾-inch sizes. Special sizes can be made to meet customer requirements.

For additional information, write Big Four Machine and Supply Company, Box 256, Clay City, Ill., *referring to* WORLD OIL *item* 110.

111—Wire Line Wiper

This item supplements Patterson-Ballagh data as shown on pages 3421-3488 of Composite Catalog.

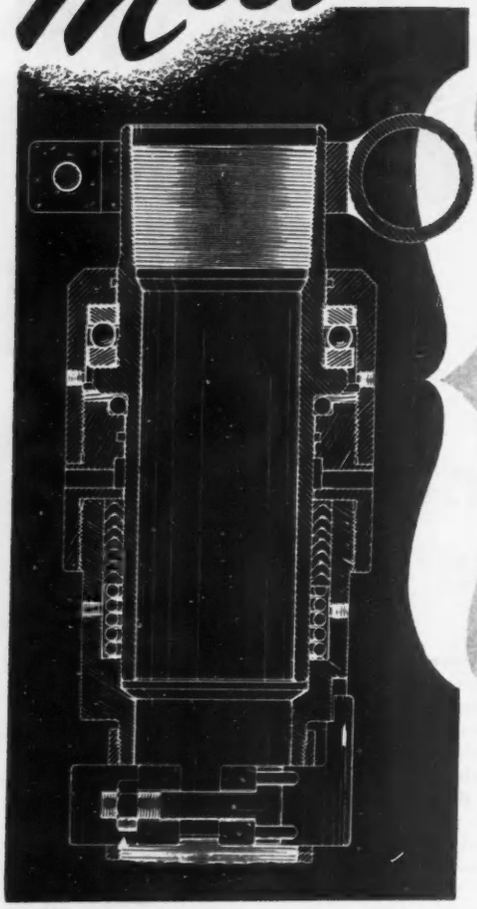
A new wire line wiper which will wipe any size wire line from one-eighth to seven-eighths inch features easy adjustment to wire line diameter, quick drainage of fluid, safety linkage that releases when line pulls tool out of the hole, and spark-proof construction.



The spiral or helical wiping element, which acts as seven individual wipers, presents a continuous wiping edge 15 inches long that conforms to the regular lay of the wire line. Wiping edge follows and wipes clean the small spiraling channels formed by individual cables that make up wire line.

For additional information, write Patterson-Ballagh, Division of Byron Jackson Company, P. O. Box 2493, Terminal Annex, Los Angeles 54, *referring to* WORLD OIL *item* 111.

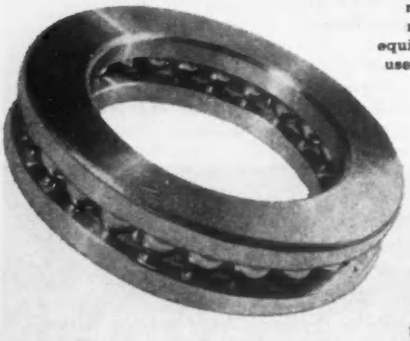
Meet A TEAM that can take it!



Halliburton

CASING SWIVEL with BEARING BY Aetna

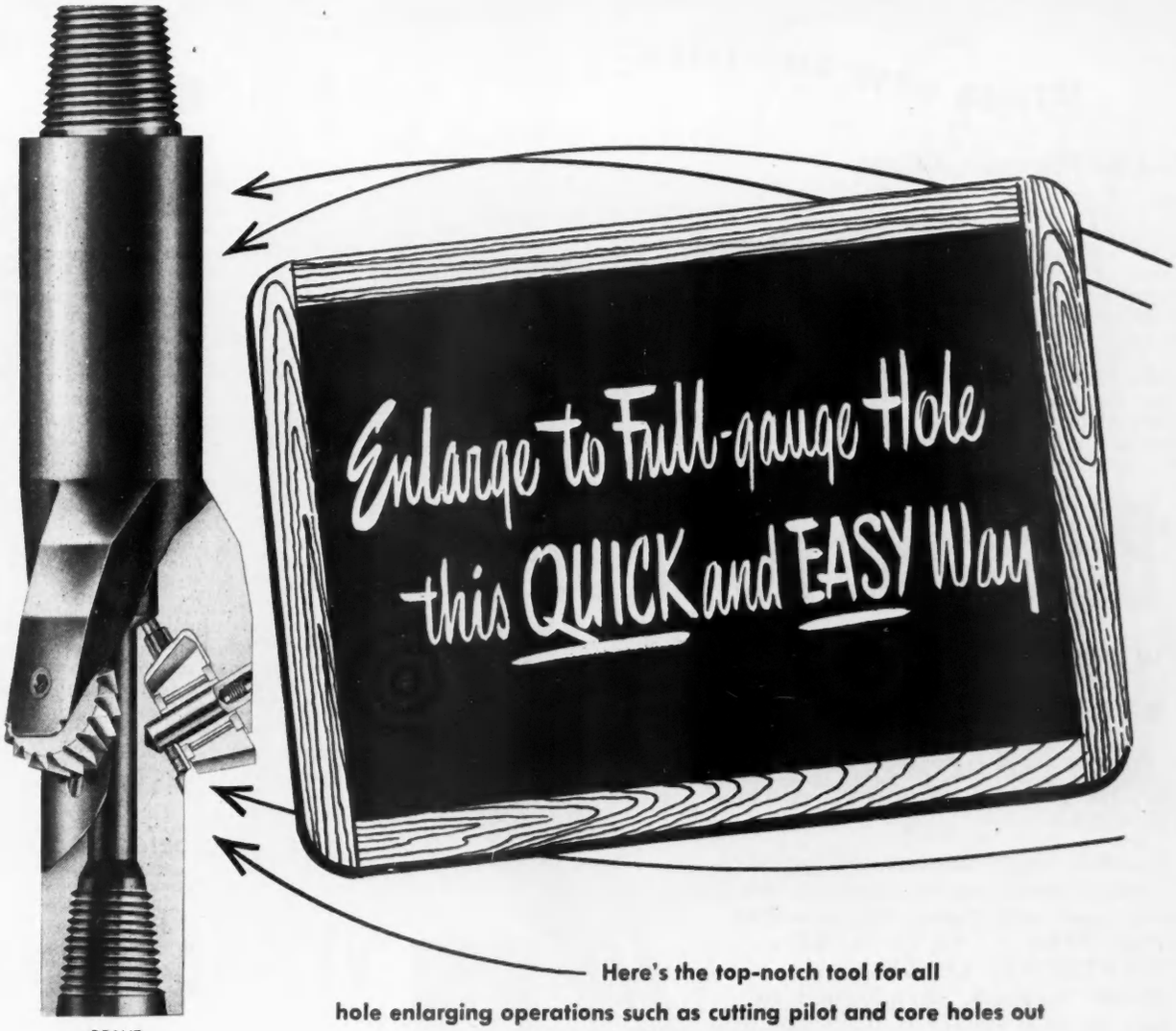
Halliburton Casing Swivels are built to last on tough jobs, and included among their sturdy components is an Aetna bearing custom-engineered to meet the high thrust capacity, precision smoothness and long, trouble-free performance required in this application. You will find Aetna custom-built bearings assigned to an increasing number of the oil country's most rugged applications. In rotary tables, crown and traveling blocks, plug valves, swivels—wherever thrust loads must be entrusted to bearings of utmost dependability that's where Aetna quality helps to avoid costly down-time . pare down maintenance cost . stretch equipment life. That's why it makes economical sense to specify Aetna bearings for the equipment you make—or to buy equipment in which they are used. Write for catalog and name of nearest representative.



AETNA BALL & ROLLER BEARING CO.
4600 Schubert Avenue • Chicago 39, Illinois

Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings

Aetna
BALL AND ROLLER BEARINGS



GRANT
HOLE ENLARGER

Here's the top-notch tool for all hole enlarging operations such as cutting pilot and core holes out to gauge. It's the Grant Hole Enlarger— and here are important reasons why it's outstanding for this work in any formation . . .

IT'S RUGGED—bodies are of heat-treated alloy steel . . . the three cutters are hard-faced for long wear and turn on husky precision roller bearings.

IT'S STREAMLINED—designed for maximum circulation area and with direct fluid jetting action against each cutter.

IT'S FAST—unique cutter design eliminates tracking, insures complete cutting action for positive removal of formation and straighter hole.

IT'S ECONOMICAL—cutters are replaceable right at the rig—an important time and money saver wherever you drill, and especially important in foreign fields.

Write for Bulletin 38 giving full details and specifications on the Grant Hole Enlarger — or see your nearest Grant representative today!

Proven GRANT Tools
Used Where Performance Counts

Hydrostatic Bailers	Bulletin No. 11
Liner Pullers	Bulletin No. 14
Pressure Releases	Bulletin No. 15
Casing Scrapers	Bulletin No. 17
Wall Scrapers	Bulletin No. 20
Bottom Hole Scrapers	Bulletin No. 21
Underreamers (Rotary)	Bulletin No. 24
Underreamers (Cable Tool)	Bulletin No. 27
Hole Enlargers	Bulletin No. 38
Reamers	Bulletin No. 43
Hydrostatic Perforation Cleaners	Bulletin No. 50
Dump Bailers	Bulletin No. 51
Roller Cutter Shale Bits	Bulletin No. 54
Sand Pumps	Bulletin No. 55
Impression Block Tool	Bulletin No. 56
Well Cleanout Equipment	Bulletin No. 57

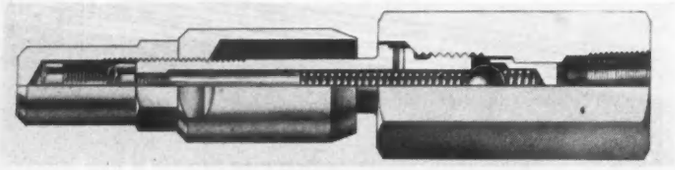
Write for Descriptive Bulletins on these GRANT Tools

GRANT
OIL TOOL COMPANY

Main Office and Plant: 2042 East Vernon, Los Angeles 11, California
Branches at Bakersfield, Avenal and Ventura, California,
and at Odessa and Houston, Texas

OTHER NEW AND IMPROVED *Equipment*

112—Low-Pressure Alarm



A low-pressure device sounds an alarm when the pressure in any compressed air system or line falls below the minimum for safe or efficient operation. For oil field use, the alarm is particularly suitable for drilling rigs where air-operated clutches and brakes are used on drawworks, preventing wear on clutch faces, brake drums and lining when the air supply falls below the required pressure. It is an excellent safety device on rigs using air-operated pumps for operating blowout preventers.

The device is fully automatic. The unitary assembly consists of a valve element which springs open when the air pressure drops below some pre-selected value and allows the escaping air to blow an integral whistle. This alarm continues to sound as long as the air pressure is less than that for which the valve is set. As soon as the pressure returns above the set point, the valve automatically closes and the whistle stops blowing.

Made of non-corrosive materials, the alarm is available in two models. The adjustable type (illustrated) is arranged so that both the pressure setting and the tone of the whistle may be adjusted in service. The non-adjustable type is permanently set at the factory for a specified pressure and differs only slightly from the adjustable type. Both types have a one-half-inch inlet connection, but this may be bushed to any size desired, as the air requirement of the device is small.

For additional information, write Airlarm, P. O. Box 6024, Houston, *referring to* WORLD OIL *item* 112.

PARAFFIN'S NO PROBLEM

when your sucker rods are equipped with

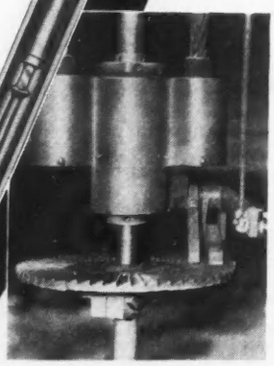
HUBER SCRAPERS

Paraffin can't accumulate in the tubing when your sucker rods are equipped with Huber Scrapers. NO PARAFFIN . . . NO TROUBLE . . . NO REMOVAL COSTS!

Huber Scrapers, shrink-fitted to new or used sucker rods, scrape paraffin from the tubing wall as the string rotates and reciprocates. This constant scraping prevents paraffin accumulation . . . eliminates paraffin removal.

Huber Scrapers quickly pay for themselves. Wells requiring paraffin removal every week or ten days have been on production for months without paraffin trouble after Huber Scrapers were installed.

If paraffin's a problem, install Huber Scrapers. Write for descriptive bulletin.



HUBER ROTATING ROD HANGER

This rod hanger rotates the rod string a fraction of a turn on each reciprocation. The horizontal teeth on the turn table are engaged by two ratchet levers which are actuated by a flexible steel cable attached to the walking beam. On each reciprocation the levers move the rod string a fraction of a turn.

SOLD THROUGH SUPPLY STORES

J. M. HUBER CORPORATION
P. O. BOX 831 BORGER, TEXAS

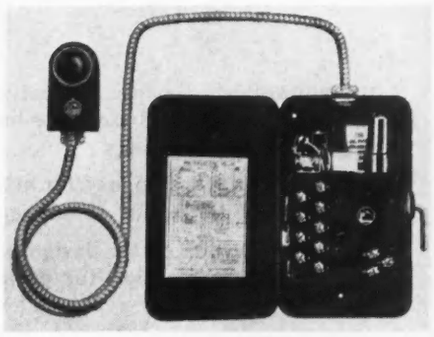
HUBER PARAFFIN SCRAPERS

SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

113—Photoelectric Control

A compact general purpose photoelectric control is adaptable where space is limited, and is designed for high speed operation, with a relay which operates in 1/20th of a second.

The phototube, which must be located where the operations are to be controlled, is available either integral with the housing or in a small separate housing, as illustrated. A tamper-proof sensitivity adjustment on the control permits positive operation over varying distances between phototube and light source and under all conditions of ambient light. The operating range of the control is ten feet. The sensitivity adjustment provides for relay operation at any predetermined level of illumination within the range of 10- to 50-foot candles.



The control can operate under conditions of extremely high temperature and humidity. Hermetically sealed, oil-filled condensers and high wattage resisters are used.

For additional information write Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass., *referring to* WORLD OIL *item* 113.

"I'll take the WHITE one every time!"

WYTEFACE "A"
Trade Mark
Steel Tapes for the Oil Industry

WYTEFACE "A" Steel Tapes have raised black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Designed for hard service. Resist rust and corrosion. Raised rims and markings protect the white background from abrasion from rails, pipe, rocks, concrete. Made in styles especially for Oil Riggers, Oil Gaugers and for general measurements. See your supply house, or write for details to Keuffel & Esser Co., Hoboken, New Jersey.

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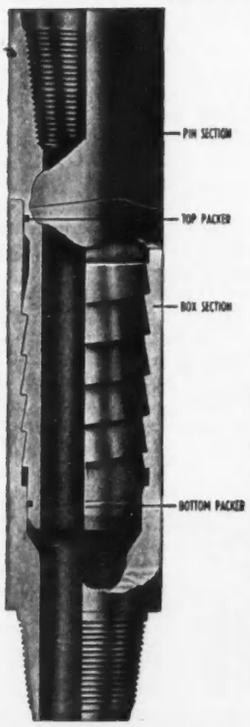
BOWEN SAFETY JOINT



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DRILLING—FISHING
FORMATION TESTING
SETTING PACKERS

O. D. and I. D. same as regular tool joints

Will not release or back off any easier than regular tool joints.

Does not interfere with drilling, fishing or testing procedures.

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Will release only by deliberate procedure of the operator.

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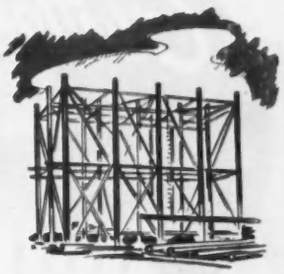
Odessa, Texas, Phone 789—Midland, Texas, Phone 1439
Oklahoma City, 6-8087—Houma, La., 6709

The Story of AVONDALE and the OIL BUSINESS



Giant STEEL platforms built for offshore drilling. Write for details.

From WAR to OIL... Conversions of all types and sizes of craft.

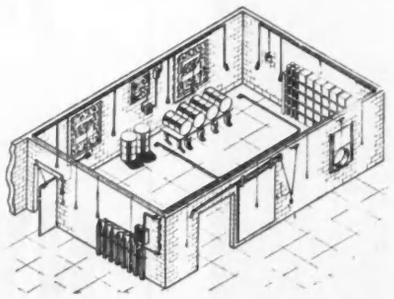
Personnel and service launches built of STEEL! Speedy, efficient, rugged.

Towboats built and repaired. Marine work is our specialty.

AVONDALE
MARINE WAYS, Inc.

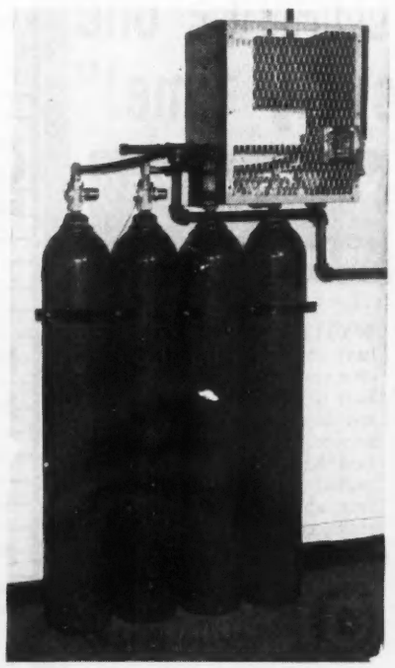
Main Plant: Avondale, La. *Quick Repair Plant: Harvey, La.*
MAIL: WESTWEGO, LA.

114—Fire Extinguisher



A carbon dioxide fire extinguishing system for protecting Class B and C risks requiring localized or total flooding, and for rotating electrical units requiring a sustained charge of carbon dioxide, automatically shuts off power units and closes windows and doors when fire strikes. The system first sounds an alarm, however, to permit employes exit from the fire area before it discharges the carbon dioxide.

It is a flexible unit, readily adaptable to all needs a fire risk requires, and is easily installed and serviced. Additional cylinders can be added should a risk be increased later to require added protection.



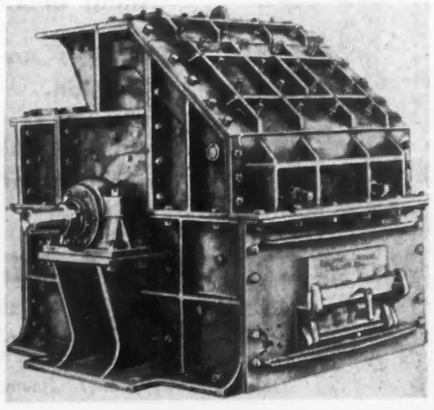
For additional information, write American-LaFrance-Foamite Corporation, Elmira, N. Y., *referring to* WORLD OIL *item* 114.

115—Crusher

A high-capacity crusher is capable of reducing 250 tons of oil shale per hour. It is of extra-heavy construction, with all crushing parts of manganese steel, and joints machined for dust-tightness. Three hammer types assure a flexible reduction action to fit each specific operating demand. Hammers are reversible, with two crushing surfaces. The replaceable grate bars are reinforced and closely fitted for accurate control of product size.

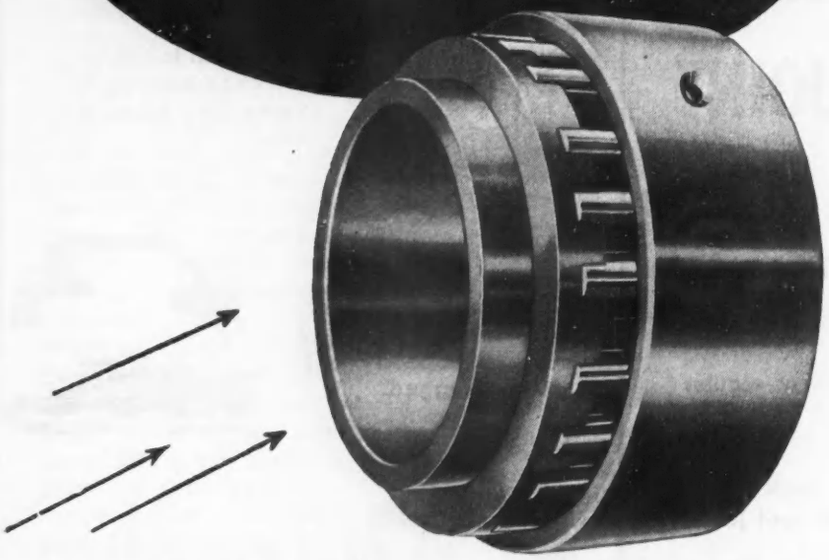
The crusher is available with a conventional front feed or a specially designed center feed that lengthens the travel of the sale in the crushing cycle.

For additional information write American Pulverizer Company, 1249 Macklind Avenue, St. Louis, *referring to* WORLD OIL *item* 115.



Gluttons for punishment

American
Heavy-Duty
Roller Bearings

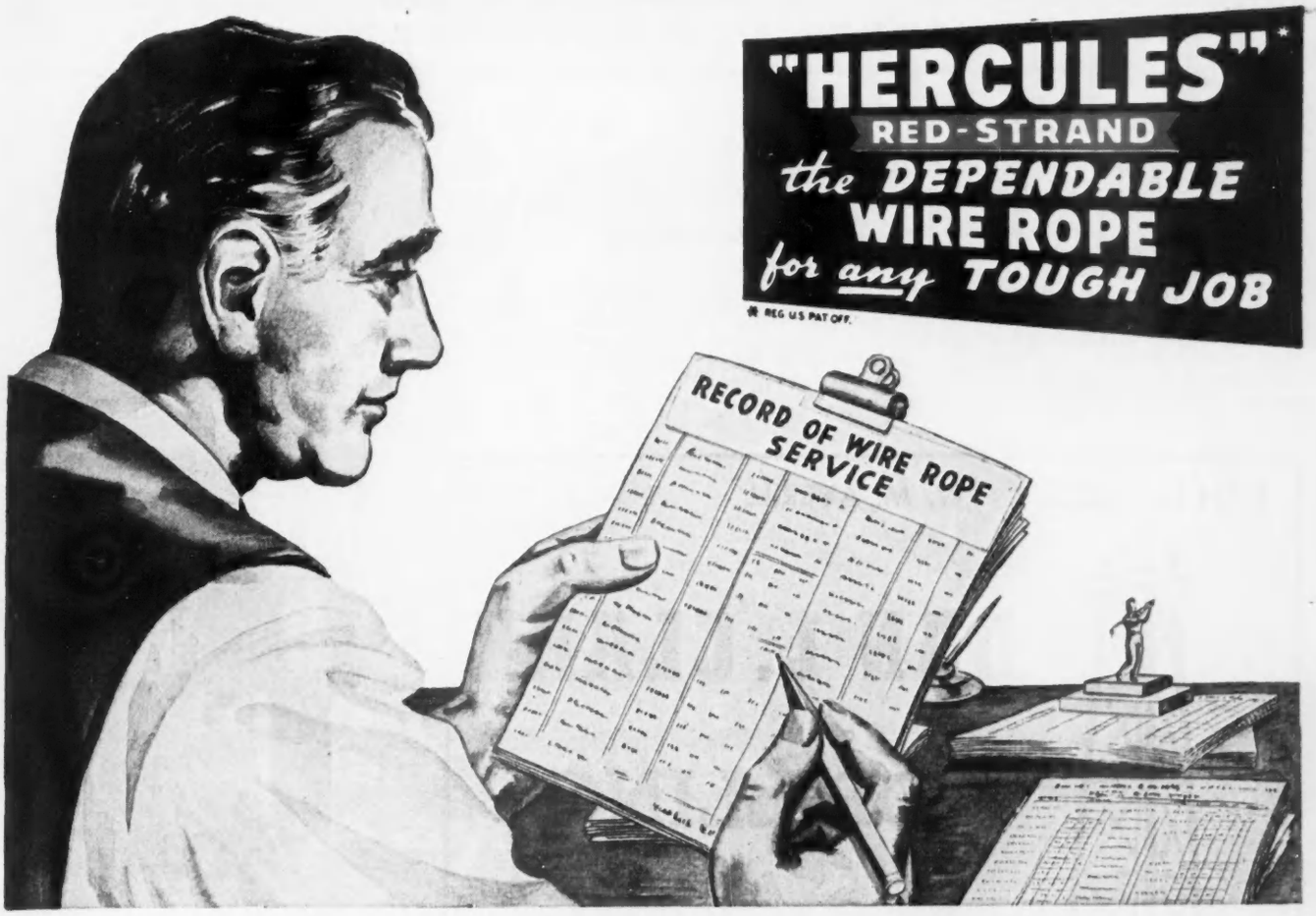


Designed especially for "tough going," AMERICANS have what it takes to render smooth, dependable service in heavy industrial applications. Strong, precision built, longer lasting, they will minimize your anti-friction bearing problems. Our technical staff will assist you in selecting the right bearings for your needs. Write.

AMERICAN ROLLER BEARINGS HEAVY DUTY

AMERICAN ROLLER BEARING CO.
420 Melwood Street Pittsburgh, Pa.

Pacific Coast Office: 1718 S. Flower St., Los Angeles, Calif.



The Proof of Economy is in PERFORMANCE

Tell us how you use wire rope, and we shall be glad to help you select the correct size and construction for your particular needs.

With wire rope, as with various other equipment, many claims can be presented . . . but in the final analysis, it is the record of PERFORMANCE that determines the ultimate cost.

By actual *on-the-job* service — over a period of many years—Preformed "HERCULES" (Red-Strand) Wire Rope has consistently proved its value by this accurate yardstick of performance.

Yes, for easier handling, safe and economical results, you can depend on the Red-Strand as your wire rope guide. In "HERCULES" there is a "right rope" for every heavy duty job.

We Invite Your Inquiries

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857

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NEW YORK 6 • CHICAGO 7 • HOUSTON 3 • DENVER 2
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116—Winter Grease

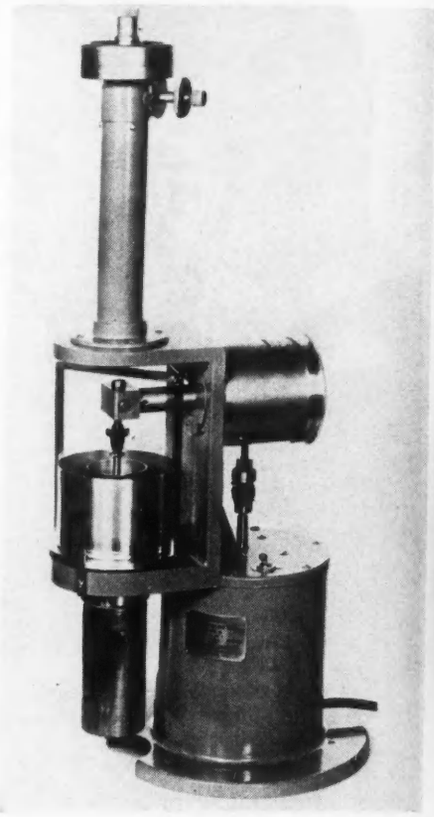
A new soft consistency grease for winter use in heavy duty industrial service has been developed. To be known as H Grease O, it has a lime soap base, is gold in color and is particularly suitable for low temperature applications.

The H Grease series is designed for general purpose industrial service where higher viscosity mineral oils are required than in conventional cup greases. The new material completes the H grease series which also includes H Grease No. 1 and No. 2.

For additional information write The Texas Company, 135 East 42nd Street, New York City, *referring to* WORLD OIL *item* 116.

117—Viscosimeter

A viscosimeter developed for The Texas Company was designed specifically for the measurement of viscosity in plastic fluids and thixatropic suspensions, or any other non-Neutonian fluid, in which viscosity varies both with rate of shear and with time, as in drilling muds and cements.



The instrument features a wide range of positive, fixed speeds, with stroboscopic arrangement for checking rotor speeds. It is capable of high velocities to allow fluids to reach equilibrium viscosity. The viscosimeter is engineered for continuous recording for any length of time, and completely friction-free torque measurement, due to torsion wire suspension. Steady readings on heavy fluids are insured by oil damping. The instrument has ample power to break jells, making accurate determination of jell strength possible.

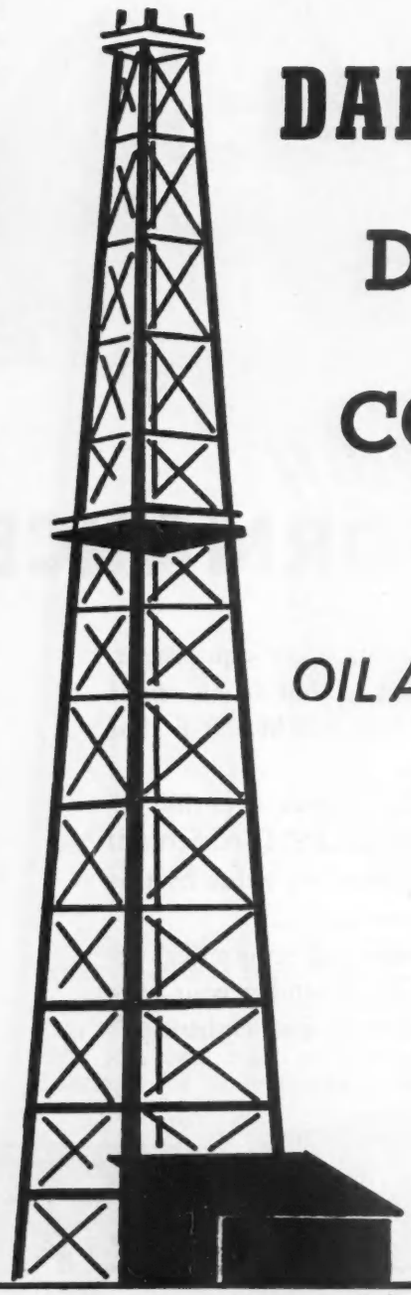
For additional information, write Southwestern Industrial Electronic Company, 2831 Post Oak Road, Houston, *referring to* WORLD OIL *item* 117.

118—Lubricator

A new light-weight lubricator for running measuring line-operated instruments in wells under pressure has been designed. Novel features are a hinged construction that permits the lubricator to be lowered to a horizontal or inclined position for easy insertion or removal of the instrument; a telescoping erecting rod for elevating the lubricator; a means for adjusting the packing around the measuring line from ground level at any time, and a pressure indicator that shows any pressure over 25 pounds in the lubricator.

The lubricator consists of a tube (3) of heat treated aluminum alloy, two inches inside diameter and any effective length to 20 feet, with heat treated aluminum alloy quick-connecting hinge (9) and Unibolt coupling (6) at the lower end, and a removable sheave (1) attached by a coupling at the upper end.

DAN L. CLARK W. M. AVERILL RUPERT COX



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Drillers of OIL AND GAS WELLS

POWER AND STEAM RIGS

WILSON BUILDING
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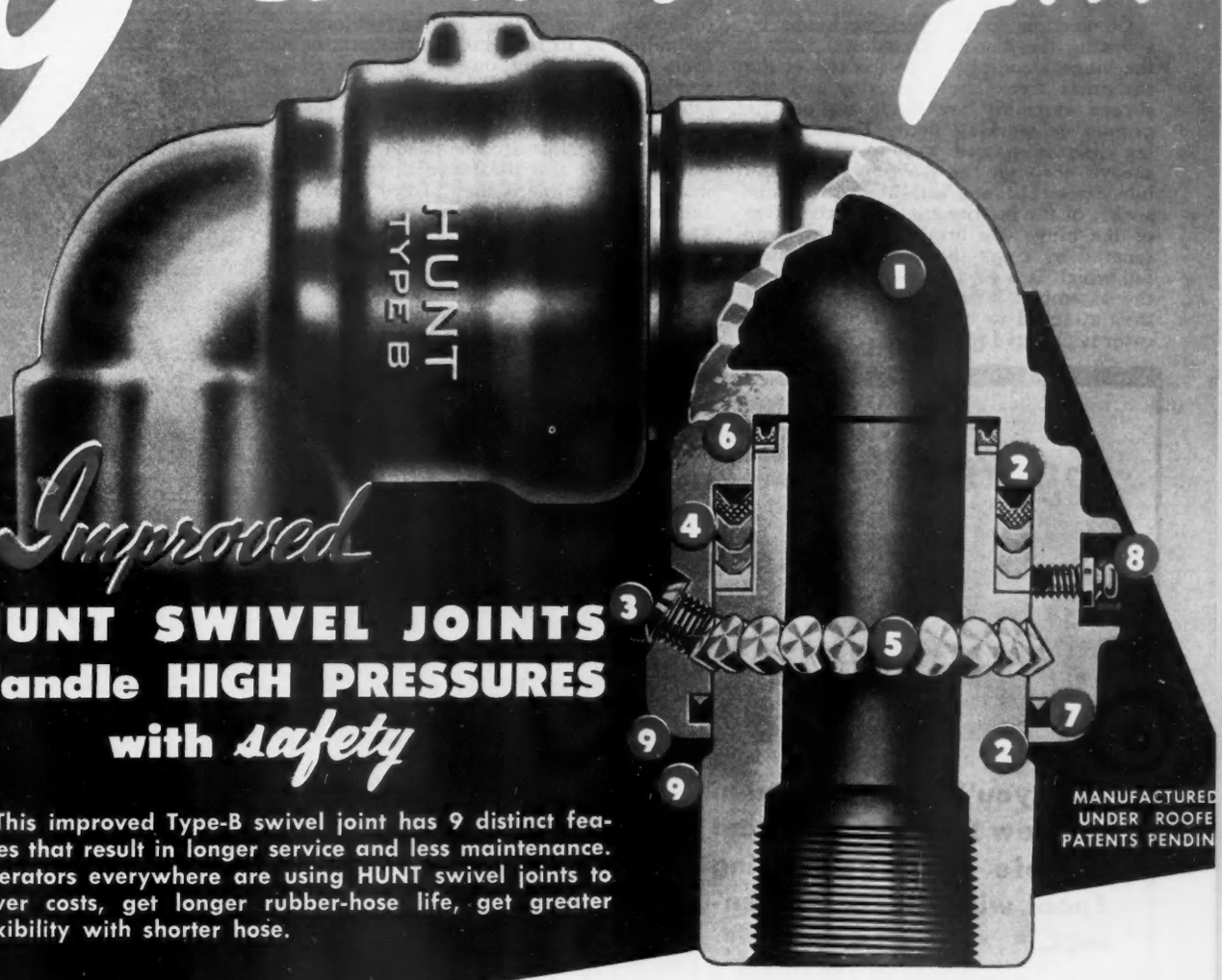
9 Reasons Why...



Improved

HUNT SWIVEL JOINTS Handle HIGH PRESSURES with *safety*

This improved Type-B swivel joint has 9 distinct features that result in longer service and less maintenance. Operators everywhere are using HUNT swivel joints to lower costs, get longer rubber-hose life, get greater flexibility with shorter hose.

1. *Full-size streamlined bore . . .* assures smoother flow of fluids, less abrasive wear
2. *Longer bearing length . . .* maintains perfect alignment of all working parts, less torque in turning
3. *Removable loading plug . . .* simplifies maintenance without adjustment, easier access to bearings
4. *Chevron-type packing . . .* provides longer service, easier repacking
5. *Greater roller - bearing contact areas . . .* greater safety against thrust and shock loads, easier turning
6. *Stronger end-seal . . .* packing prevents abrasion from fluid turbulence
7. *Better grease seal . . .* assures better lubrication, better sealing against leaks
8. *Handy grease fitting . . .* Zerk or Alemite . . . easier lubrication under working pressure
9. *Highest grade alloy steel bodies . . .* added safety under high tempeatures, high working pressures

That's why operators everywhere are specifying HUNT swivel joints for handling high pressures with safety. Write today for illustrated folder.

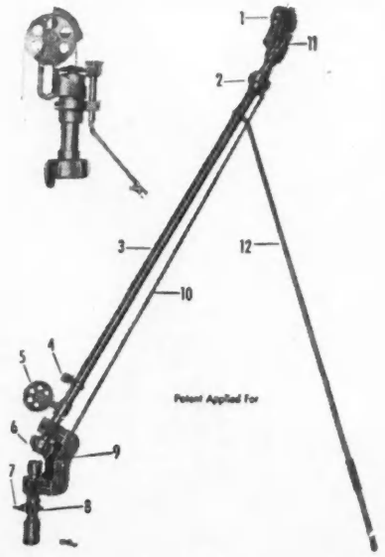
HUNT TOOL COMPANY

GENERAL OFFICES AND PLANT: HOUSTON, TEXAS
FIELD SHOPS: BAY CITY & CORPUS CHRISTI, TEXAS; JENNINGS & HARVEY, LA.
EXPORT SALES: HUNT EXPORT COMPANY, 19 RECTOR ST., NEW YORK; HOUSTON, TEXAS; BUENOS AIRES; PORT OF SPAIN; CARACAS

A BUSINESS BUILT ON *Good* SERVICE

Connection to the well is made by screwing the disconnected lower half of the hinge assembly on to the top of the christmas tree. The lubricator and top sheave assembly are made up on the ground or working floor. The measuring line is passed around the upper sheave, through the packing gland and lubricator tube, and attached to the rope socket of the instrument. The two halves of the hinge are brought together and secured by rings slipped over the steel pin which is a part of the upper half of the assembly. The erecting rod (12) is then attached to the tube and the lubricator is elevated to inclined position. The telescoping erecting rod is nine feet long, extending to 16 feet, the instruments or tools are made up on the ground or working floor and pulled up into the lubricator and the line secured by the line clamp (4) just above the lower sheave. The lubricator is raised to vertical position and the lower coupling is made up. The line is then placed around the removable lower sheave (5) and the line clamp released.

As shown, the packing gland, which accommodates any size measuring line, can be tightened to compensate for line wear from ground level by turning the



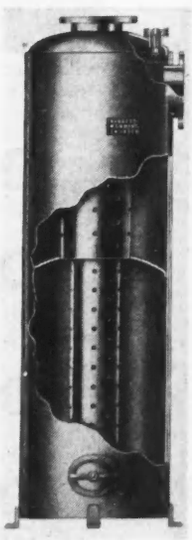
long operating rod (10) that controls the gland gear.

A valuable safety feature is a pressure indicator (8) which shows any pressure above 25 pounds that may be in the lubricator after the christmas tree valve is closed at the end of a run. The bleeder valve (7) for relieving pressure is located below the lubricator next to the pressure indicator.

For additional information write Dale Company, 6412 McKinley Avenue, Los Angeles 1, *referring to* WORLD OIL *item* 118.

119—Exhaust Snubber

A new line of side inlet exhaust snubbers with "fog-jet" is designed for use on two and four-stroke cycle stationary gas engines requiring control of exhaust explosions during starting, as well as continuous suppression of sparks. Designated as Series SDL, these units are available in pipe sizes from five to 30 inches.



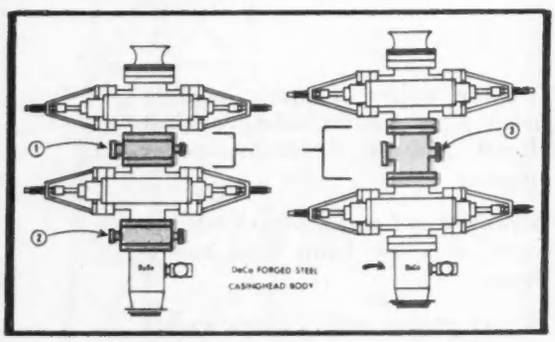
The snubber incorporates a fog-jet which sprays a cooling water mist into the exhaust gases. Flame from the engine is also cooled and extinguished, while gas in the snubber is made non-inflammable by the mist.

Exhaust slugs entering the snubber spin off a deflecting plate. The spinning action scrubs and breaks up carbon and other foreign material. The gas then spins into the second scrubbing section. Before the exhaust gas emerges, glowing sparks have been scrubbed out.

For additional information write Burgess-Manning Company, Libertyville, Ill., *referring to* WORLD OIL *item* 119.

ARE YOU CRAMPED FOR CELLAR SPACE?

Then you'll be interested in the new DeCo Forged Steel Double Studded Drilling Spool with elliptical openings.



The arrangements at the left show a comparison between the DeCo Double Studded, Elliptical Outlet Drilling Spool, Type DSFO, and the DeCo Open Flange Drilling Spool, Type DFFO. The arrangement on the left utilizes two Double Studded Drilling Spools with elliptical openings in less cellar space than is used with one spool type adapter as shown on the right.

1. DeCo Doubled Studded Drilling Spool Type DSFO Series 900 with elliptical outlets. OVERALL HEIGHT 9 INCHES, 6 inch flow line, 3 inch fillup line.
2. DeCo Double Studded Drilling Spool Type DSFO, Series 900, with elliptical outlets. OVERALL HEIGHT 6 IN. 3 inch flow line and fillup line or smaller.
3. DeCo Open Flange Drilling Spool Type DFFO, Series 900. OVERALL HEIGHT 22 INCHES. 6 inch flow line, 3 inch fillup line or smaller.

DeCo oil field equipment sold through leading supply stores.

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C★S

THOMPSON-HAYWARD

FORMALDEHYDE

for corrosion control

You can protect your casings, rods, and all exposed metal parts for only a few cents a day. You can

- **SAVE ON PULLING COSTS**
- **SAVE ON NEW STEEL**
- **SAVE ON SHUTDOWN TIME**

Thompson-Hayward Formaldehyde gives dependable protection from hydrogen sulphide corrosion and corrosive mine and well waters.

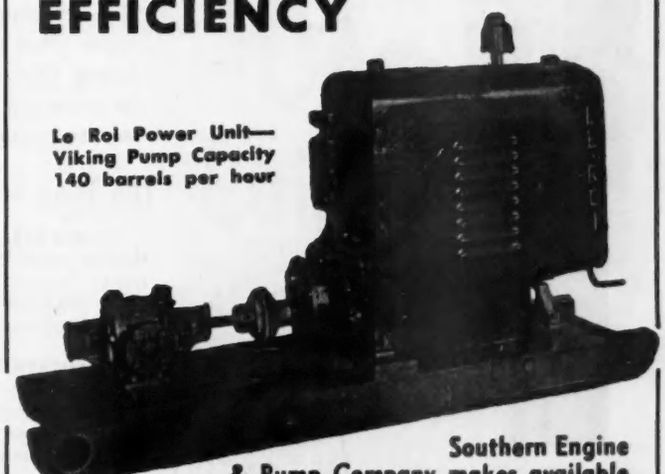
Write our nearest office for detailed information

THOMPSON-HAYWARD CHEMICAL CO.

Dallas, Wichita, Houston, Tulsa, New Orleans, Denver, San Antonio

(B)

THE RIGHT TEAM FOR EFFICIENCY



Le Roi Power Unit—
Viking Pump Capacity
140 barrels per hour

Southern Engine & Pump Company makes available to you 40 years of "KNOW HOW" in your pumping requirements.

• Complete units and replacement parts at all branches.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS

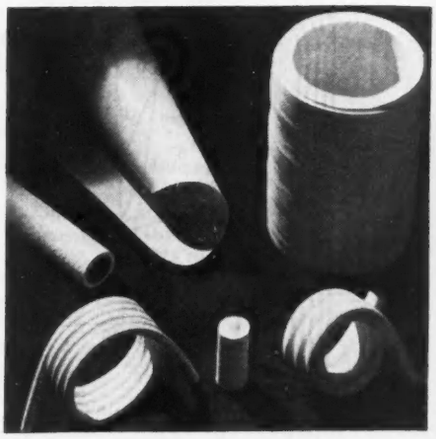
Houston - Dallas - Kilgore - San Antonio
Edinburg - Lafayette, La.

120—Silicone Rubber

Gaskets, diaphragms, grommets, washers, seals, packings, tubing and numerous other extruded and molded products are now available from the new X-7 Silicone rubber. The material has better than twice the resistance to permanent compression over former types of Silicone rubber and a somewhat greater tensile strength.

In addition to being suitable for dielectric applications, the rubber is practically unaffected by temperatures ranging from —160° F. to more than 500°F. It looks and in many ways acts like conventional rubber, and it retains these rubber-like qualities and elasticity at extreme temperatures.

The rubber is recommended for use in handling hot or cold fluids and gases, as well as for applications where rubber comes into contact with extremes of hot or cold conditions. It will not become brittle and will not crack after long exposure to air or ultra-violet rays.



Parts will not turn to carbon despite heat, and they can be used to replace metal constructions in which limited thermal stability has been experienced.

Parts resist the chemical action of lubricating oils and some chemicals.

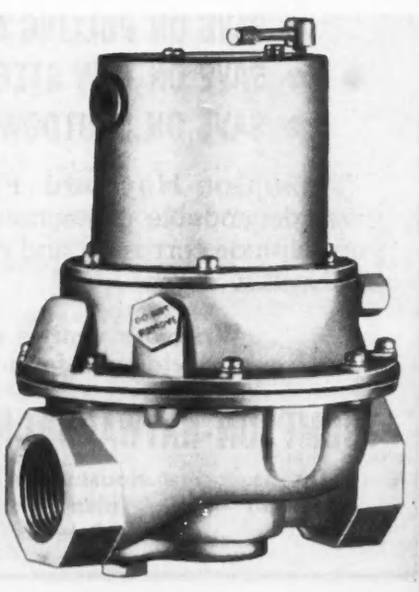
For additional information, write The Stalwart Rubber Company, 192 Northfield Road, Bedford, O., *referring to* WORLD OIL *item* 120.

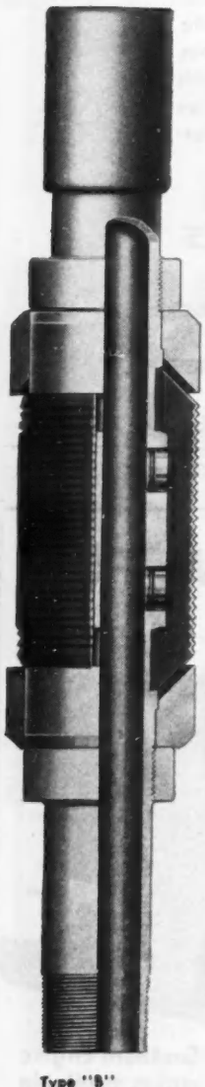
121—Gas Valve

The B-50 electric diaphragm gas valve is designed for control of natural, manufactured, mixed and liquefied petroleum gases to space and unit heaters, central, floor and wall furnaces and boilers.

The valve is silent and has no packing glands or bellows to impede operations. It can be used for low or line voltage applications, and has a current consumption of only five watts. It is available in standard model or manual opening model with or without electric trip. The envelope size of the valve makes it adaptable to any gas-fired heating installation. All body parts are die formed aluminum of high density and tensile strength.

For additional information, write General Controls Company, 801 Allen Avenue, Glendale 1, Calif., *referring to* WORLD OIL *item* 121.





Type "B" Tubing Anchor

STOP TUBING TRAVEL with the PAGE Tubing Anchor

PAGE TENSION TOOLS

THE PAGE TYPE "B" Tubing Anchor gives you *six* advantages never before realized in conventional type anchors . . . they're possible because the Page Type "B" incorporates an entirely different operating principle—*it sets hydrostatically and holds hydraulically!*

The Page Type "B" Tubing Anchor permits . . . *(1)—assembly in the tubing string either end up (2)—fast run-in without danger of "accidentally" setting slips (3)—automatic setting without tubing manipulation (4)—setting at correct depths because slips set as fluid rises in tubing (5)—compensation for temperature changes (6)—easy release by simply draining tubing.*

The Type "B" Eliminates...

REVERSE TORQUE on tubing threads—main cause for high pressure leaks.

EXCESSIVE WEAR on casing, tubing and rods—common with compression anchors.

SUCKER ROD BREAKAGE caused by excessive tubing travel. The Page Type "B" Tubing Anchor keeps rod breakage at a minimum because it *smooths out* reversals in the pumping cycle.

Field records prove...

. . . that anchoring the Page Way *increases* pump efficiency and *decreases* equipment wear —visit your nearest D+B Pump Store or Continental Supply Store — find out how Page "Tension Type" Tools can help *you!*

PAGE OIL TOOLS, Inc.
3356 Lime Ave., Long Beach 7, Calif.

Mid-Continent Distributors
D+B Division—Emsco Derrick & Equipment Co., Garland, Texas
The Continental Supply Company Dallas, Texas

SMOOTH RUNNING SHEAVES
. . . STATICALLY BALANCED

EASY TO HANDLE!

EXCLUSIVE DOUBLE ROW AMERICAN ROLLER BEARINGS

QUICK RIGGING! LIFT IN ONE PIECE BY ONE LINE ON END SPACER

PERFECT SHEAVE ALIGNMENT!

SIDE PLATES ARE ALLOY ROLLED STEEL

HOOK BOLTS MAKE HOLE ALIGNMENT EASY

BOTH THE CROWN AND TRAVELING BLOCKS HAVE:

BEARINGS that are really engineered for the job—exclusive double row sealed AMERICAN roller bearings having integral thrust shoulders, assuring perfect sheave alignment. ***SHEAVES*** are statically balanced, smooth running, large diameter—rope grooves are flame hardened for longer sheave and rope life. Grooved to A. P. I. Standards and can be welded and recut. Sheaves and bearings are INTERCHANGEABLE between mating Wheland Crown and Traveling Blocks. ***LUBRICATION*** is by conveniently located pressure grease fittings direct to inner race of each individual bearing.

ENGINEERED WITH A MINIMUM 4 TO 1 FACTOR OF SAFETY

WHELAND
CROWN *and* TRAVELING
BLOCKS

"THE BEST BUY IN BLOCKS"

A FAST FALLING BLOCK! NARROWER, SHORTER EASIER TO HANDLE! STABLE!

EASY TO REEVE!

FULLY STREAMLINED —NOTHING TO HANG UP . . .

STREAMLINED, COMPACT, STRONG, EASIER TO HANDLE

WHELAND CROWN BLOCKS, J-2500—250 Ton, J-3500—350 Ton—Fully streamlined heavy duty—light, compact, strong. Can be taken up in one piece on a single line over end spacer castings. Compact, will pass A. P. I. water table opening. Easy to anchor securely by hook bolts. Easy to line up with hole and keep lined up. Easy to reeve. Optional arrangements for cat line and sand line sheaves. Meets A. P. I. Specifications. Full mechanical details sent free on request.

WHELAND TRAVELING BLOCKS, K-600—60 Ton, K-1350—135 Ton, K-2500—250 Ton, K-3500—350 Ton—Fully streamlined heavy duty, fast falling—and unusually stable because of low center of gravity and smooth running large diameter sheaves. They are easy to handle, easy to reeve. The three piece guards are arranged for reeving cable without removal. However, each side guard may be readily swung out or removed for inspection or reeving. Heavy steel plate guards fully protect cable and prevent jumping from sheave grooves. Quick and full opening bottom bail—alloy steel forging.

These blocks meet the new A. P. I. Tentative Standards. A study of the many superior design and construction features will quickly show you why we say: "The Best Buy in Blocks."

Write Dept. W-2 for Bulletins giving mechanical details. Free on request.

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.

ROTARY DRILLING MACHINERY

DOMESTIC DISTRIBUTORS

Jones & Laughlin Supply Co.
Tulsa, Oklahoma

Stores and Offices in all Principal Oil Fields and Centers

EXPORT DISTRIBUTORS

Lucey Export Corporation
233 Broadway,
New York 7, N. Y.

Broad Street House
London E.C. 2, England

DRAW WORKS • SLUSH PUMPS • ROTARIES • SWIVELS • CROWN BLOCKS • TRAVELING BLOCKS

122—Sand Pumps

Illustrations and price lists of the complete line of Miller sand pumps and bailers are presented in a new catalog. Construction of the tools is described, as well as the operation of the clean-out instruments.

For a copy of this folder write Miller Sand Pump Company, P. O. Box 4516, Oklahoma City 9, *referring to* WORLD OIL *item* 122.

123—Horizontal Boring

Howell Pipe Line Tools has introduced a DG drill bit, reamer and water adapter for horizontal boring through hard and soft soils, building walls and roadways and many other materials. Instructions and illustrations are given in a bulletin issued by this company.

For a copy write Howell Pipe Line Tools, Utility Tool Company, 651 Bloomington Avenue, Rialto, Calif., *referring to* WORLD OIL *item* 123.

124—Flange Dimensions

A 20-page illustrated booklet of flange dimensions is based on American Petroleum Institute standard 6B.

For a copy of the booklet write the Engineering Department, Oil Center Tool Company, 1912 Airline Drive, Houston, *referring to* WORLD OIL *item* 124.

125—Telegraph Systems

Stability, margin, and range for teleprinter and multiplex applications are listed as prominent features of the Lenkurt Type 22 Telegraph System described in a new folder, Form 22P4. This publication illustrates the arrangement of a single channel of the equipment, shows the design of individual transmitter and receiver panels and lists six specific ways in which this basic equipment can be applied to telegraph communication problems.

For a copy of this folder, write Lenkurt Electric Company, 1147 County Road, San Carlos, Calif., *referring to* WORLD OIL *item* 125.

126—Gun Perforating

The developers of the engineered acidizing process have published a four-page illustrated folder on gun perforating. Operating in the Permian Basin, the company features new equipment, including custom-built trucks and a new gun with a folded barrel.

For a copy of this folder write The Western Company, Midland, Texas, *referring to* WORLD OIL *item* 126.

127—Drawworks

Bulletin 358, 24 pages, gives complete illustrated descriptions of two Ideal steam-driven drawworks, the 34-8½-FE and 34-10-FE, in three-shaft, four-speed, fully enclosed jack-shaft types.

The bulletin outlines features of construction and operation with profuse illustrations of details, gives complete specifications, shaft diagrams, and typical dimensional drawing for installation.

For a copy of this bulletin, write The National Supply Company, Box 899A, Toledo, Ohio, *referring to* WORLD OIL *item* 127.

128—Diesel Engine

"Hercules Diesel Engines — General Information," discusses in detail the fundamentals of diesel power and its advantages; Hercules diesel engine construction with enlightening sectional illustrations; a treatise on the patented Hercules combustion chamber and a detailed description of how it functions; the operation of the four-cycle engine with functional charts and diagrams; and a discussion of fuel injection equipment and governors.

For a copy of this book, write Hercules Motors Corporation, Canton, Ohio, *referring to* WORLD OIL *item* 128.

129—Valves

The first edition of a new lubricated plug valve catalog consisting of 16 pages, fully illustrated, and provided with dimensional drawings, tables, and descriptive matter, covers the complete line of Porter lubricated plug valves.

A feature is a full-page cross-section view of the valve with an accompanying explanation.

For a copy of this catalog, write H. K. Porter Company, Inc., 7001 W. 66th Place, Chicago 38, *referring to* WORLD OIL *item* 129.

Bottom Water is a drain on profits

Eagle Lead Wool

shuts out Bottom Water!

To insure an uninterrupted flow of oil from your wells, banish bottom water with economical Eagle Lead Wool. This finely stranded metallic wool, tamped around the hole, effectively seals every crack, becomes a permanent, non-corrosive plug. Packed in convenient 50-pound sacks—easy to place in special cartridge-shaped Eagle Wire Containers sized to fit all casings.

These 3 Eagle Bearing Metals meet most requirements

Eagle Dreadnaught — for extreme speed and heavy-duty conditions.

Eagle Outlasta — for medium speed and average-load conditions.

Eagle Durable—for low speed and light-duty conditions.

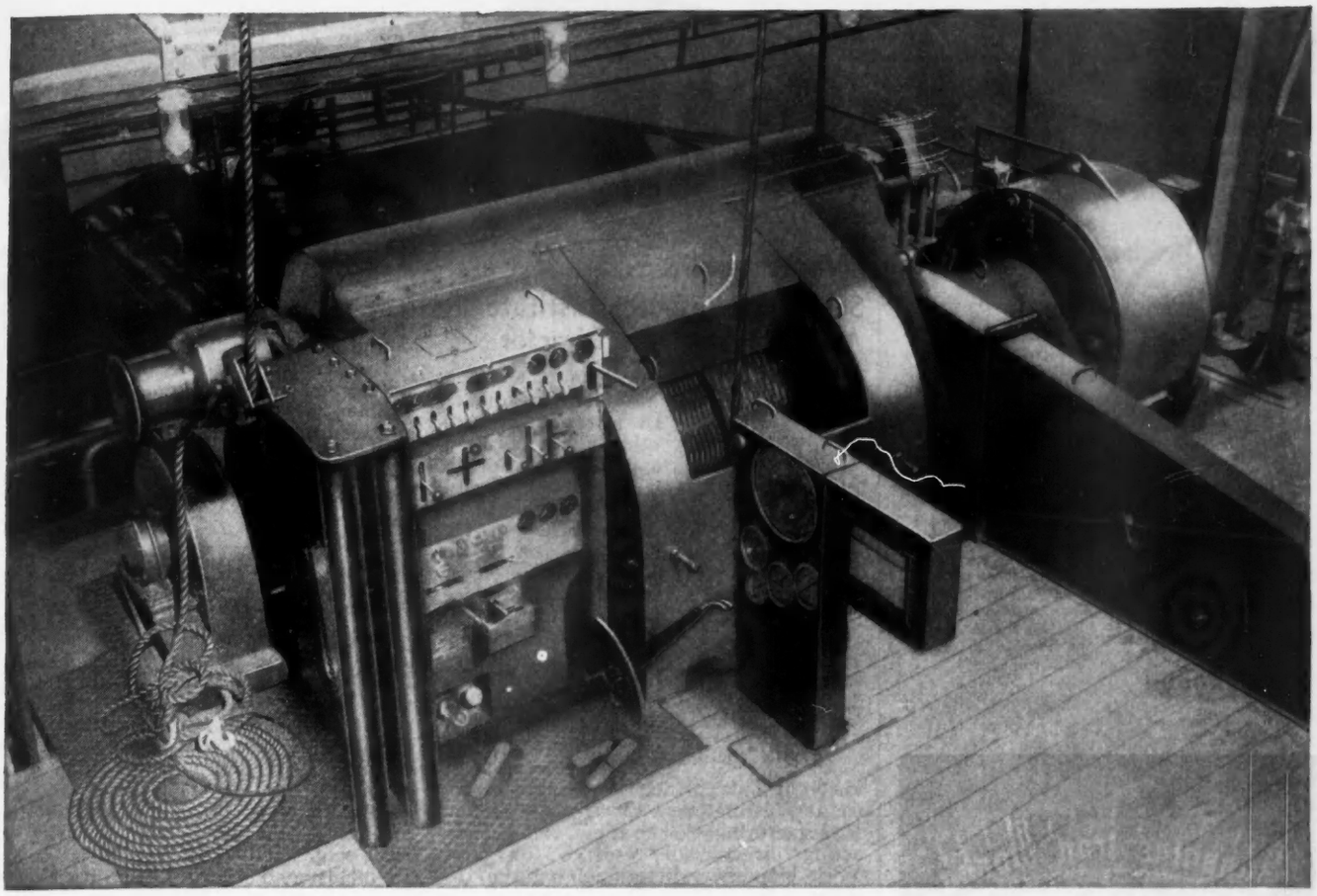
EAGLE LEAD WOOL

Seals off Bottom Water— keeps 'em flowing!

THE EAGLE-PICHER COMPANY

EAGLE Since EP 1843 PICHER

Cincinnati . East St. Louis
Chicago . Dallas . Kansas City



Speed Up Round Trips with Frictionless Magnetic Braking

The Dynamatic Drawworks Brake is completely magnetic; no friction or wear; no brake blocks or bands to replace. Proved by outstanding records in all fields, including off-shore operations

- Simple as a light circuit.
- Precision control from driller's position.
- Operates on ordinary light plant current.
- High torque at low speeds.
- Sets slips on heaviest strings without friction brake.
- Readily applied to all rigs—large or small. Can be installed in the field.
- Sold with unconditional guarantee of satisfaction.

Dynamatic Drawworks Brakes are available from drawworks manufacturers and their distributors. Write for illustrated literature.

DYNAMATIC
ELECTRO-MAGNETIC

DRAWWORKS BRAKES

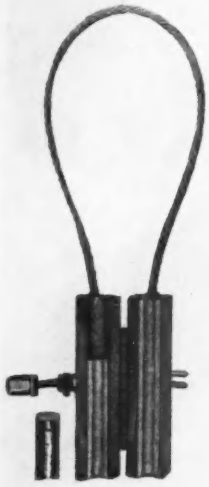
Sales and Service Representatives
GRIBBIN & BAYLOR
Los Angeles, Cal.
Houston, Fort Worth and Odessa, Texas
Jennings, La.

EATON

DYNAMATIC DIVISION KENOSHA, WISCONSIN
EATON MANUFACTURING COMPANY, CLEVELAND, OHIO

Spare that line!

Approximately 6000 feet of line can be spooled TIGHT on the drum with assured safety, before you need to change the removable bronze liners of the S-I-W Line Tightener.



SPOOL TIGHT WITH AN S-I-W LINE TIGHTENER

An adjustable hasp permits quick opening and closing of the S-I-W Line Tightener. A cable loop permits easy swinging from the derrick. Closed, the S-I-W Line Tightener grips running line firmly for even drum spooling. Steel liners can be supplied at no extra cost.

Sunshine Iron Works

601 W. MURPHY - PHONE 4374 - ODESSA, TEXAS

HEAVY DUTY-RUGGED....

THE INDUSTRY'S LEADING CENTRIFUGE

*3480

You can maintain your required speed for the full period of the test with much less effort. Curtin centrifuges, proven world-wide, are heavy duty, rigidly constructed, and extremely simple in design. Illustrated bulletin, giving full details, available upon request.

W·H·CURTIN & CO.

HOUSTON .... NEW ORLEANS

Associations

Southwest Research Institute Appoints Associate Director

Dr. Emory N. Kemler of New York City, research and production engineer in petroleum and other fields, has been appointed associate director of Southwest Research Institute in Houston. He succeeds Dr. John V. Pennington, who is on leave of absence from the Institute to direct the Drilling Research, Inc., program.

E. N. Kemler

Formerly in charge of production engineering for a Gulf Oil Corporation division at Tulsa with prior research service at Westinghouse Electric and Dodge Manufacturing Corporation, Kemler was acting director of research for New York University before joining the Institute. He will be in charge of the Houston activities of the Institute, including the establishment of a petroleum research laboratory, as soon as negotiations for a site and a building are completed.

Kemler has supervised experimental production engineering work in the petroleum field, equipment selection and replacement research, analysis of oil well repair expense, investigations of pumping problems, and bottom hole pressure pumping, flowing and temperature studies.

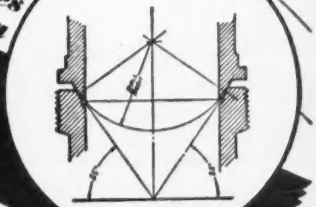
November 7-10 Set as Dates For API Meeting In Chicago

Chicago will be the site of the 29th annual meeting of the American Petroleum Institute November 7-10. The annual meetings have been held in Chicago continuously since 1942, with the exception of 1944, when no meeting was held because of wartime transportation difficulties.

Los Angeles has been selected as the location of the 30th annual meeting in 1950, which will be held November 13-16, inclusive. This will be the first West Coast meeting of the Institute since 1941, when the annual meeting was held in San Francisco.

CATAWISSA

BALL-TO-ANGLE SEAT gives you a PERFECT SEAL...



...even when the pipe is not perfectly aligned!

HOT FORGED STEEL
STAINLESS STEEL

Full ACME Threads or U. S. V-Threads in Union nuts and on female end.

STANDARD AND DOUBLE EXTRA HEAVY

HOT FORGED from solid, rectangular steel bars, Catawissa Pipe Unions are free from sand and blow holes. The ball-to-angle seat design plus their ability to expand and contract with the pipe give you sure fire dependability . . . a perfect seal for every application!

DISTRIBUTED BY

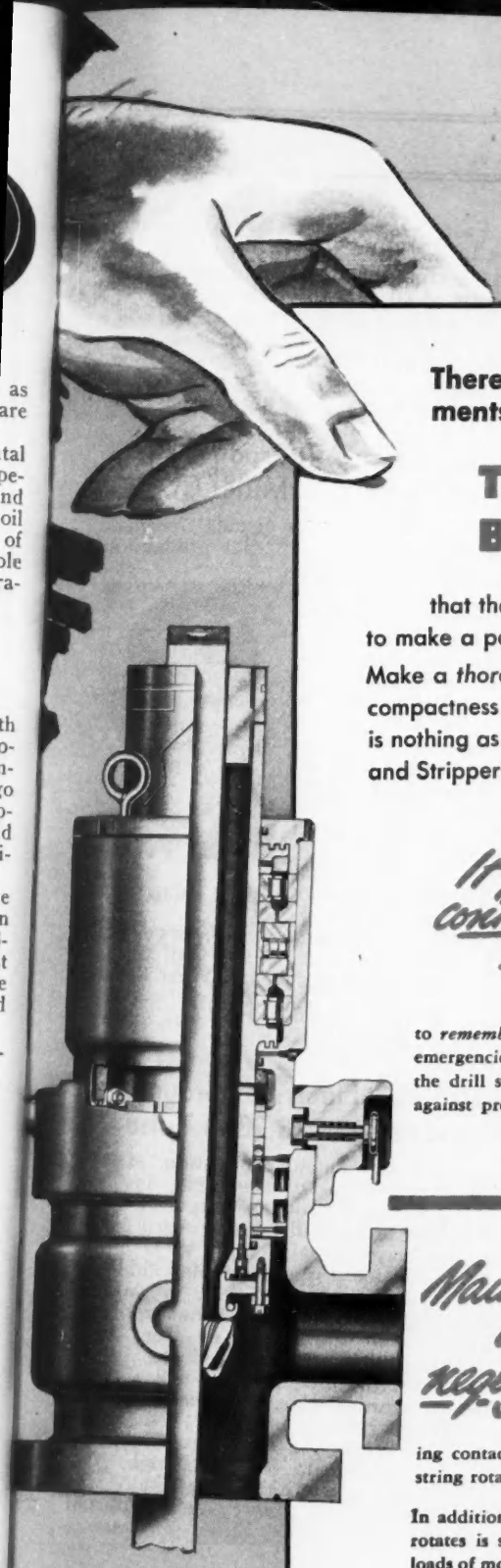
OIL WELL SUPPLY COMPANY

BRANCHES SERVING ALL OIL FIELDS

WRITE FOR BULLETIN 10-A

CATAWISSA VALVE & FITTINGS COMPANY CATAWISSA, PENNA.

We invite you to look it over... check its features...weigh its many advantages for pressure control on today's drilling operations!



There are so *many* performance features, so *many* far-reaching advancements built into . . .

THE SHAFFER COMBINATION ROTATING BLOW-OUT PREVENTER AND STRIPPER

that the only way you can fully appreciate its vital importance to modern drilling operations is to make a point-by-point comparison with *any other similar equipment on the market.*

Make a *thorough* check. Compare operating simplicity . . . fool-proof dependability . . . space-saving compactness . . . and the many other features essential to complete pressure control. You'll find there is nothing as *complete,* nothing as *advanced* as the Shaffer Combination Rotating Blow-Out Preventer and Stripper! Here are just a few of its many advantages . . .

It provides continuous seal!

Because the Shaffer Combination Rotating Blow-Out Preventer and Stripper maintains its leak-proof seal *continuously* while pipe is in the hole, there is nothing to *operate,* nothing to *remember,* nothing to *forget* when sudden pressure emergencies occur. The unit is *always* packed-off around the drill string . . . *always* ready for instant protection against pressure blow-outs!

It seals around any shape!

In addition to maintaining a continuous pressure-tight seal, the stripper rubber in the Shaffer Combination Rotating Blow-Out Preventer and Stripper also expands and contracts *automatically* to fit the various shapes and diameters in the drill string. It seals around square, hexagon and octagon kellys as well as around drill pipe. And, excepting such abnormally large diameters as bits and reamers, the varying diameters of the tool joints, upsets, couplings, substitutes, etc., readily strip through the unit without losing the pressure-tight seal!

Maintenance is negligible!

Because the Stripper Unit and kelly rotate together—not one inside the other—wear on the Stripper Rubber is reduced to a minimum. Moreover, there is no flexing of the Stripper Rubber or loss of sealing contact around the kelly or drill pipe as the drill string rotates, thus-assuring a continuous and tight seal.

In addition, the bearing assembly upon which the unit rotates is specially engineered to withstand the severe loads of modern high speed drilling, with separate thrust and radial bearings to carry each type of load. Bearings are lifetime pre-packed with heat-resisting lubricant, further minimizing maintenance!

No Special equipment required!

In addition to its many other advantages, the Shaffer Combination Rotating Blow-Out Preventer and Stripper requires no special kellys or drill strings for its operation. The unit seals off around *any* type of pipe—coupled, upset or flush—with equal efficiency and safety whether the drill string is being raised or lowered, rotated or not. Also, a square, hexagon or octagon kelly may be used—whichever is preferred—and the unit seals automatically and continuously around each type.

What's more, such abnormally large diameters as bits and reamers can be readily passed through the unit by simply pulling a latch and rotating the Bonnet 1/6th turn, whereupon the entire internal mechanism is withdrawn with the bit or reamer. Simply reverse the operation when going back into the hole. It's easy, *quick!*

Note the compactness and simplicity of the Shaffer Combination Rotating Blow-Out Preventer and Stripper. Also note its built-in circulation connections that further save space and simplify hook-ups.

PLUS MANY OTHER ADVANTAGES—Still other important advantages include unusual *compactness* that saves cellar space . . . Steel Reinforcing Latches that prevent damage to the stripper rubber when pulling large diameters through it—or by excessive well pressures . . . and many other unique advancements that make the Shaffer Combination Rotating Blow-Out Preventer and Stripper the most *efficient,* most *versatile,* most *positive* pressure control unit yet developed. Get *all* the details from your Shaffer representative. Or write direct!

See pages 3843 to 3894 of your 1948 Composite Catalog for information on the complete Shaffer Line.

Write for your free copy of the new Shaffer Catalog.

26 Yrs. OF OIL TOO LEADERSHI

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXC

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and T
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Stree
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

IPAA Names Texas Oil Men To Special Import Committee

The Independent Petroleum Association of America moved into the first phase of a new battle against imported oil by naming nine Texas oil men to a special import policy committee. They are H. J. Porter, Houston; George A. Hill, Jr., Houston; J. P. Coleman, Wichita Falls; Charles F. Roeser, Fort Worth; Maston Nixon, Corpus Christi; V. C. Perini, Jr., Abilene; Bryan W. Payne, Tyler; Robert L. Wood, Midland; and C. L. O'Brien, Amarillo.

One of the strongest statements IPAA has ever made was adopted at a Wichita Falls meeting and a motion was made, immediately following the adoption of the statement, to appoint the special committee to formulate a definite plan of action against what IPAA termed "an increasing flood of imports."

The statement said, in part, "The few large importing companies, through shortsightedness, indifference, or selfish interests, are endangering the national security in their rush to produce and sell their foreign oil in the markets of this country."

"Most of their foreign reserves," this statement pointed out, "are in the Middle East, less than two hours bombing time from Russia."

A meeting of the committee, which consists of 40 men from all parts of the U. S., will be called as soon as possible with a view toward taking some definite action toward limiting the importation of foreign oil to the amount necessary to supplement domestic production.

Southwestern API Production Group Elects E. B. Miller, Jr.

E. B. Miller, Jr., was elected chairman of the Southwestern district production division of the American Petroleum Institute at its convention at Galveston.

E. B. Miller, Jr.

Regional vice chairmen elected are John Tom Reynolds, Lafayette, La., South Louisiana; J. D. Davis, Jackson, Miss., Alabama and Mississippi; Frank Wood, Wichita Falls, North Texas; C. Jacob Haas, Shreveport, Arkansas - North Louisiana; John S. Bell, Tyler, East Texas; George Staples, Corpus Christi, Texas Gulf Coast; Don Miller, Odessa, Texas, West Texas-New Mexico.

R. E. Heitdecker, Dallas, was elected secretary-treasurer.

Petroleum Electrical Groups Convene April 26-28 In Tulsa

The 21st annual convention of the Petroleum Industry Electrical Association and the Petroleum Electrical Supply Association will be held April 26-28, at the Mayo Hotel, Tulsa. V. J. Sittel, senior electrical engineer, Stanolind Oil and Gas Company, Tulsa, is general chairman and announces that approximately 500 representatives from both organizations are expected to be in Tulsa for the meeting at which a number of technical papers will be presented.

Present officers of the PIEA are D. H. Levy, Magnolia Pipe Line Company, Dallas, president; R. M. Slough, The Ohio Oil Company, Findlay, Ohio, vice president; W. H. Massey, Interstate Oil Pipe Line Company, Shreveport, secretary-treasurer.

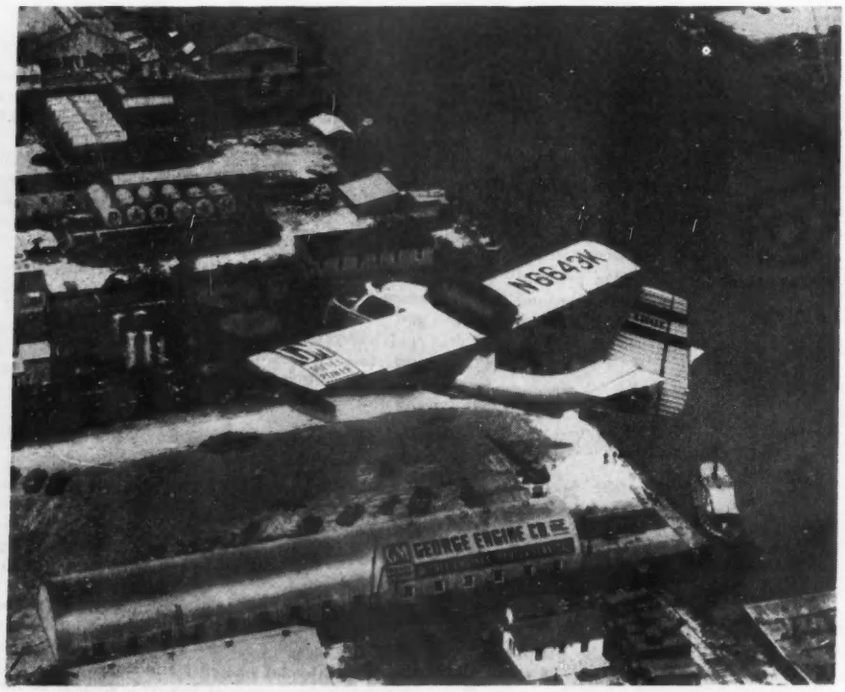
Officers of PESA include C. A. Heiser, Anaconda Wire and Cable Company, Dallas, president; Carl Mullins, Nelson Electric Supply Company, Tulsa, vice president; E. N. Jolliff, Crouse-Hinds Company, Dallas, secretary - treasurer; E. C. Lyle, Westinghouse Electric Supply, Houston, chairman of the board.

Safety Group Names Ball

B. F. Ball, president of the San Francisco chapter of the National Safety Council, has been named vice president and director of industrial safety for the California Safety Association. Ball, a graduate of Dartmouth University, has been with General Petroleum Corporation since 1931 and has been manager of the northern California division for the past three years.

Introducing our

FLYING "TROUBLE-WAGON"



● We are proud of our new Republic Seabee Seaplane, which is constantly alerted to answer your calls for service on G. M. Diesel-powered boats and rigs. Now, there's no need to suffer serious delays and shutdowns due to missing or broken parts. Give us a call, and we will literally come flying, bringing parts and mechanics to straighten out your trouble. No location is too remote or inaccessible for our flying "trouble-wagon."

● In a further effort to round out our service we have opened two new branches. The one at 630 Destrehan Avenue, on the Harvey Canal, has a canal-side dock where you can tie up. The other, in the aircraft hangar at Grande Isle, is maintained with a particular view to the convenience of operators in that vicinity.

● All of our shops are completely outfitted to service and rebuild G. M. engines. Each is fully staffed with mechanics and completely stocked with parts, and operated on a 24-hour basis.

"Round the Clock Parts and Service"

George ENGINE CO., Inc.

1111 Jefferson Highway, P. O. Box 10054
630 Destrehan Avenue (on Harvey Canal) NEW ORLEANS 21, LA.

Lake Charles Branch—718 Front Street

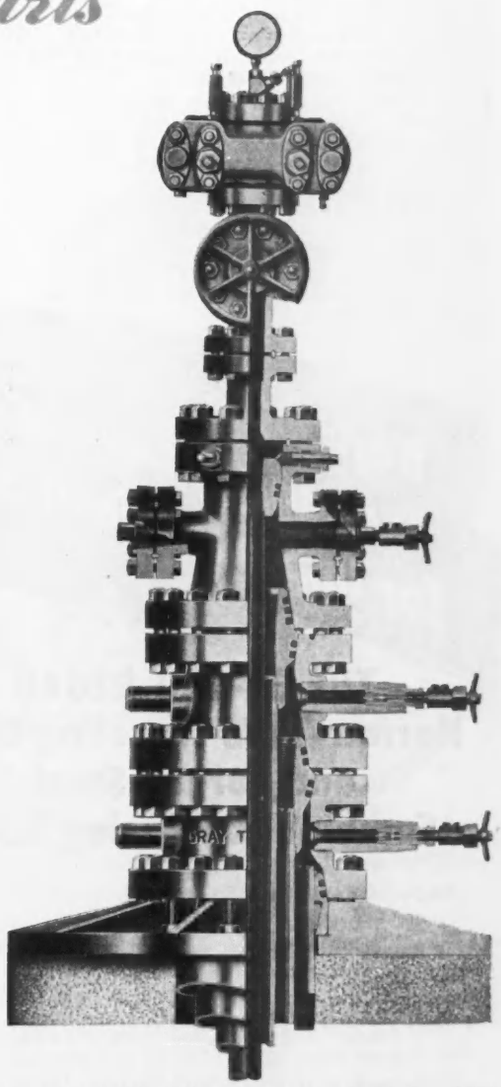
BRANCHES AT: — HOUMA — BERWICK — GRANDE ISLE

Fine Individual Parts

plus

COORDINATION

The GRAY name on a system of well control assures the operator that the operating conditions have been individually studied, that each operation has been considered as it is to be performed, and that the system has been coordinated into a unitary whole. Thoughtful combination of the best materials available, careful craftsmanship and engineering to achieve simplicity of design result in coordinated systems of well control. These assure the operator the highest degree of control, economy, flexibility and safety in the entire sequence of operations from drilling through producing the well.



Complete Well Head Assembly equipped with Type 3170 Composite Manifold, Valve Removal, Installation and Renewal and Boll Weevil Casing and Tubing Hangers.

GRAY TOOL COMPANY

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Export Representative: GUY E. DANIELS, 30 Rockefeller Plaza, New York City

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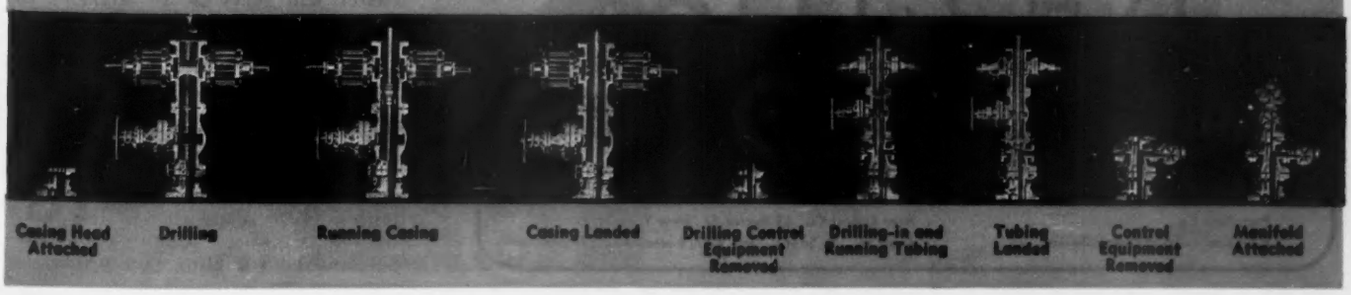

Petroleum Geologists Elect; Award Honorary Memberships

Dr. C. W. Tomlinson of Ardmore, Okla., has been elected president of the American Association of Petroleum Geologists. Other officers for the 1949-1950 term include Dr. Theodore A. Link, Toronto, Ont., vice president; Henry N. Toler, Jackson, Miss., secretary-treasurer; and Dr. Alfred H. Bell, Urbana, Ill., editor of the AAPG Bulletin.

Certificates of honorary membership in the AAPG have been given to George C. Gester, San Francisco, and Dr. Francis M. Van Tuyl, Golden, Colo.

Tomlinson received his Ph.D. degree in geology from the University of Chicago in 1916. After doing geological work in Kansas for The Carter Oil Company in 1916, he taught geology at Mississippi State College and at the University of Illinois. He joined the Gulf Oil Company in 1918 and left in 1921 to work for the Schermerhorn Oil Company. In 1936 he became an independent consulting geologist and oil producer. A life member of the AAPG, Tomlinson has been associated for many years with geological work in connection with Oklahoma structural geology and stratigraphy.

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Narrow-Type Traveling Block and Forged Steel Combination Casing Hook

200-TON CAPACITY

...but only 135½" from bight of hook to top of traveling block—the shortest overall working height ever offered for such capacity!

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Special adapter reduces friction, allowing the forged alloy steel combination hook to smoothly swivel at the right angle to traveling block sheaves. The traveling block is compact, narrow, streamlined for maximum safety and ease of operation.

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Link was chief geologist with the Imperial Oil Limited at the time the discovery of the Leduc oil field on the Central Plains of Alberta, near Edmonton. Previously, he was chief of the field party credited with locating the first oil well in North West Territories, and for many years was in charge of exploration in western Canada during the development of Turner Valley, Alberta. An independent consulting geologist since resigning from Imperial in 1948, Link is currently directing the Canadian exploration efforts of various interests from his offices in Toronto and Calgary.

Toler worked in 1930 as a geological scout for the Gulf Production Company, Fort Worth, and later as geologist for Gulf Refining Company, Shreveport. He resigned in 1931 to become consultant and assistant Mississippi oil and gas supervisor, and in 1936 he was made Mississippi oil and gas supervisor. In 1938 he joined Southern Natural Gas Company, Jackson, Miss., as manager of the Geological and Land department.

Since receiving his Ph.D. degree in geology from the University of Chicago in 1926, Bell has been with the Illinois State Geological Survey. He has been head of the Oil and Gas division since 1930. He has served on the AAPG Business Committee, Committee for Publication, Research Committee, Medal Award Committee, and the Committtee on Statistics of Exploratory Drilling.

Chief geologist of the Standard Oil Company of California for 27 years, and consulting geologist to the company since 1944, Gester is a past president of the AAPG. He is the author of "Observations Relating to Origin and Accumulation of Oil in California," "World Petroleum Reserves and Petroleum Statistics," and, as junior author, papers on the Yates field, Pecos County, Texas, and Huntington Beach oil field, Orange County, Calif.

Van Tuyl, professor of geology and head of the Department of Geology of the Colorado School of Mines during the past 30 years, has combined academic work with private consulting assignments involving practical applications of geological science in the search for new oil and gas fields. He is a member of the AAPG Research Committee and the Economics Advisory, Engineering and Research Committtees of the Interstate Oil Compact Commission.

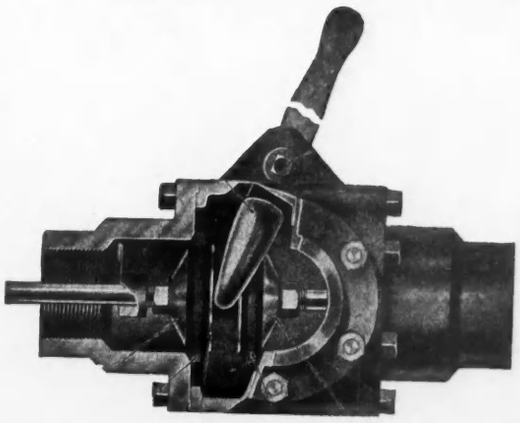
Penn Grade Names Production Advisor, Renews Research Plan

Dr. S. T. Yuster of the Pennsylvania State College, State College, Penn., will act as advisor on the production research program of the Pennsylvania Grade Crude Oil Association.

Yuster will serve in an advisory capacity pending completion of plans for direction of the research program, which was formerly supervised by Dr. Richard V. Hughes, who resigned to join the faculty of Stanford University.

Chief of the petroleum and natural gas division, School of Mineral Industries at State College, Yuster heads the school's petroleum production research activities. He is a member of the Interstate Oil Compact Commission's research and coordinating committee.

BIG 4 STANDPIPE VALVES



The Big Four Standpipe Valve gives you instantaneous shifting between standpipes on your rig, with full opening on the operating side and positive shutoff on the side not operating.

Whenever necessary, the reversible insert rubber seats may be replaced on the rig, easily. Rugged construction guarantees longer life. (Usual repairs consist only of replacing this valve seat.)

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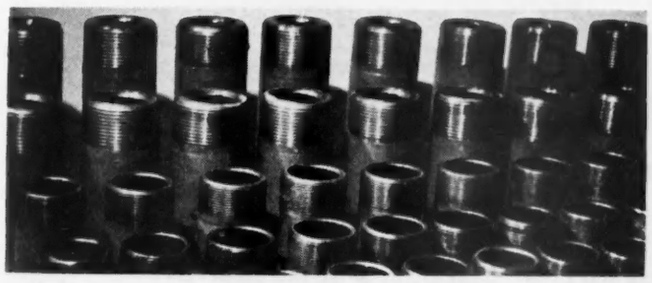

Manufactured from *new* seamless tubing, precision machined for taper and bevel, accurately threaded and gauged.

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Sizes: ¼" through 6⅝" in standard lengths. Special sizes, brass, stainless and monel furnished to your requirements.

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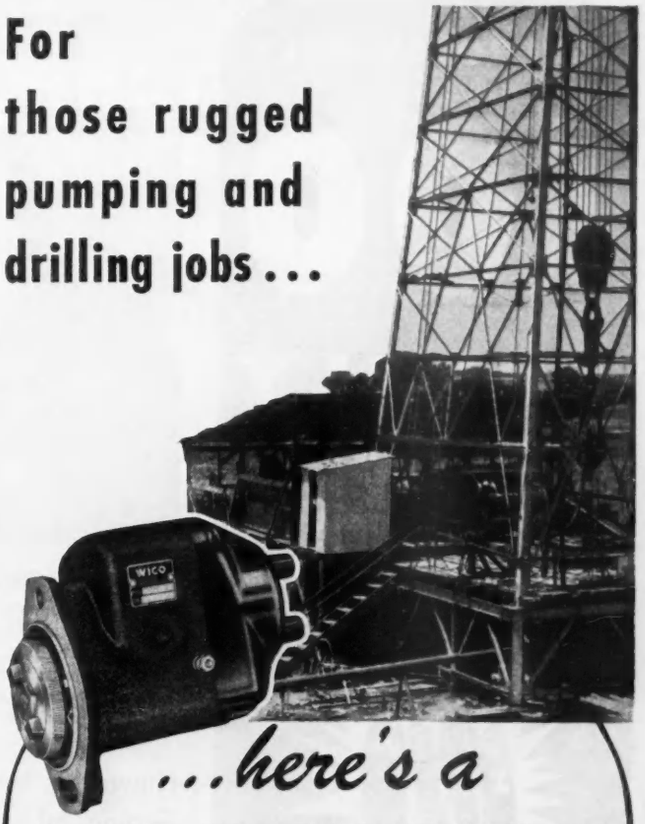

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NEW, COMPACT WICO heavy duty magneto

NO matter how many hours of continuous service you need . . . no matter how much dust or dampness . . . your engine will get the regular, hot spark it needs from this WICO Model XHD magneto. It's a *new* magneto, designed to do the hard work you need done. It's compact. The molded insulated coil is stronger so there's less chance of breakdown. This solid plastic case is far tougher than a tape winding. A specially made bronze bushing and ball bearing, lubricated for life, insure trouble-free service. The large — 3/16" — tungsten contacts resist fouling, wear longer. Built-in impulse coupling. On flange-mounted models, a Buna-N oil seal prevents leakage. Available for 4 or 6 cylinder engines, flange or base mounted.

This *new* WICO Model XHD is the finest magneto available for engines operating in continuous service under the most adverse conditions that require ignition units of exceptional stamina and ruggedness.

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ASSOCIATIONS

HEADS INFORMATION COMMITTEE—Guy Tate, center, Magnolia Petroleum Company vice-president, receives portfolio as chairman of the Gulf-Southwest Oil Industry Information Committee from Fred F. Murray, left, Oil Well Supply Company president, retiring chairman, who resigned after two years of service. John P. Morgan, Sun Oil Company, right, was drafted for another term as vice chairman. Tate was elected at a meeting of the committee which extended a testimonial of appreciation to Murray for "the outstanding performance in the industry's informational program." C. J. Guzzo, Gulf Refining Company, New Orleans, not in picture, was also named a district vice-chairman.

Hinyard Is Named South Texas Geological Society President

Paul B. Hinyard, district geologist, Shell Oil Company, Inc., San Antonio, has been elected president of the South Texas Geological Society. Other new officers are J. Boyd Best, district geologist, The Ohio Oil Company, San Antonio, vice president; and Louis H. Haring, Jr., Stanolind Oil and Gas Company, San Antonio, secretary-treasurer.

Members of the executive committee are Marion J. Moore, district geologist, Sunray Oil Corporation, and James K. Rogers, district geologist, Arkansas Fuel Oil Corporation, both of San Antonio.

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RIDES AIRBORNE. . .TO EACH LOCATION!

ANOTHER EXAMPLE OF COMPACT, DEPENDABLE...

WISCONSIN HEAVY DUTY *Air-Cooled* ENGINE *Serviceability*

Whether riding airborne by helicopter . . . or "washing down" special "shot hole" casings 90 feet deep . . . this Wisconsin Heavy-Duty Air-Cooled Engine-powered pump "pays off" for geophysical exploration crews.

Its lightness, compactness, yet rugged construction mean easier handling on soggy marshes . . . more equipment hauled per "payload" . . . and, above all, *dependability plus* on every job. Overheating doesn't happen! Engine cools by AIR in temperatures up to 140°F., yet will start easily and run steadily in sub-zero weather, thanks to a "hot" magneto with impulse coupling, plus trouble-free AIR COOLING. Every Wisconsin crankshaft rides on two sets of tapered roller bearings, taking up all thrust, one of the heavy-duty service features that enables Wisconsin Engines to match the *work capacity* of your equipment.

Supplied in 4-cycle single, 2-, and V-type 4-cylinder types. . . 2 to 30 hp.

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510 Atlas Building, Tulsa, Oklahoma
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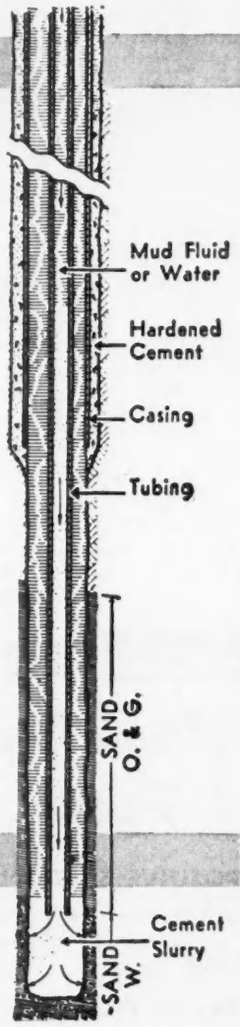
Oil field distributors for Wisconsin Engines and all types of utility units.

For Plug-Back Cementing...

*UNAFLO pumps easily...sets hard



CONVENTIONAL PLUG-BACK OPERATION

Neat cement slurry being introduced through tubing.

TIME IS NEEDED, in plug-back jobs, to manipulate the pipe and other equipment. The cement slurry inside and outside the pipe is sometimes stationary for extended periods while exposed to the higher temperatures near the well bottom. To reverse out the excess slurry under such conditions and avoid seizing the drill pipe, the slurry must remain fluid and pumpable.

Unaflo oil-well cement, with its delayed, postponed, *retarded* set, is ideal for plug-back cementing. Ample time is allowed to reverse out slurry and protect equipment—even under emergency conditions and extremely high temperatures. After the period of retardation, easy-flowing Unaflo sets normally, forming a hard, impervious seal.

Send for this helpful FREE bulletin. Here, in handy reference form you'll find the many advantages of Unaflo clearly explained. Practical case histories back up technical information with actual oil-well applications. Easy-to-follow diagrams illustrate the sections dealing with various cementing operations. To get your copy of **"Unaflo Oil-Well Cement,"** write today to Universal Atlas Cement Company.

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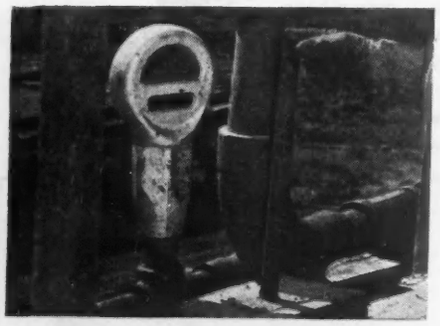
VISIBILITY 30 FEET

ACCURATE-STEADY PRESSURE MEASUREMENTS

On a drilling rig, where mud line pressures often become suddenly important, the across-the-floor readability of the large, bold, black figures against the contrasting yellow dial of the Mud Line Pressure Gauge offers a definite advantage.

Cameron Pressure Gauges are *accurate* because the unique design eliminates the conventional Bourdon tube and provides, instead, a spring loading design which is extremely accurate to line pressure changes. These Gauges give a *steady* reading because of a self-contained damping mechanism which is effective over the entire pressure range without adjustment.

Sturdily constructed, and with the external parts working in oil, these fine Cameron Gauges are providing long trouble-free operation under the severe field conditions for which they were designed.



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Men in the Industry NEWS

George B. Kitchel, Houston, has joined Kerr-McGee Oil Industries, Inc., as assistant to Travis M. Kerr, vice president in charge of the company's drilling department, with headquarters in Oklahoma City. He will be in charge of field operations.

George B. Kitchel

For the past seven years, Kitchel has been engineer in charge of the Drilling Equipment division of Humble Oil & Refining Company, and served as intermediate manager between Production department management and field personnel and other groups in matters involving drilling equipment.

Kitchel was graduated from Rice Institute in 1931 with a degree in mechanical engineering. He was employed by J. H. McEvoy & Company as designing engineer, and later by Halliburton Oil Well Cementing Company. Since 1932, with the exception of one year when he was associated with the Broderick Boiler Company as design engineer and field representative, he has been with Humble.

»

M. W. Sherwin, district geologist for Sohio Petroleum Company at Jackson, Miss., has been promoted to division geologist in Houston.

»

W. M. Walmsley has joined the regional staff of Seaboard Oil of Delaware at Midland, Texas, as a landman.

»

W. H. Ainsworth, general auditor for United Gas Corporation, United Gas Pipe Line Company and Union Producing Company since 1946, has retired. Ainsworth was 65 on January 16, and would have passed the 20th anniversary of service with United on March 20.

Ainsworth joined the firm in 1929 and was made assistant general auditor in 1930. He became general auditor for all the United companies in 1946. He was in charge of the Plant Reclassification department and was chairman of United's Files and Records Storage committee.

»

Frank Champion, Houston independent oil operator, and **Roxie Wright** have organized the Wright Drilling Company. Champion is president and general manager of the new firm, and Wright is vice president and will supervise field operations of the company, chiefly in the upper Gulf Coast area.

Headquarters will be in Room 1325 of the Niels Esperson Building, Houston, which is also the headquarters of Champion Oil & Gas Company and Champion-Smith, Inc.

Wright started with the Rio Bravo Company as a roughneck and roustabout. He was with Rio Bravo at Pierce Junction, Texas, as a driller from 1925 to 1930 and was then field superintendent for two years. Later he worked for Smith & Hamill, and started in business as a drilling contractor in 1939.

Champion was formerly a vice president and general manager of the oil tool division of Byron-Jackson Company. He is a member of the Los Angeles and Houston chapters of Nomads.

»

Robert N. Williams, Honolulu Oil Corporation district geologist with headquarters in Santa Barbara, Calif., has resigned to go into consulting work. Williams will have offices with the firm of Penfield and Smith, civil engineers of Santa Barbara, and will do consulting work on both water and oil. He was formerly district geologist for Honolulu in Bakersfield and after his return from the Army was made district geologist in Santa Barbara.

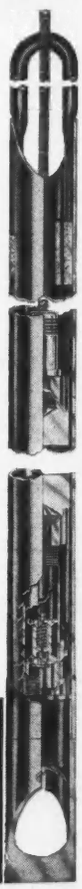
Robert N. Williams

»

George H. Gaul has resigned from Sinclair Wyoming Oil Company to become a consulting geologist with offices in the Newhouse Building, Salt Lake City. He served as a geologist with Sinclair Wyoming for eight years.

Hessman SAND PUMPS

Clean Wells Faster



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Rubber cup sleeve provides positive suction with maximum lifting power.

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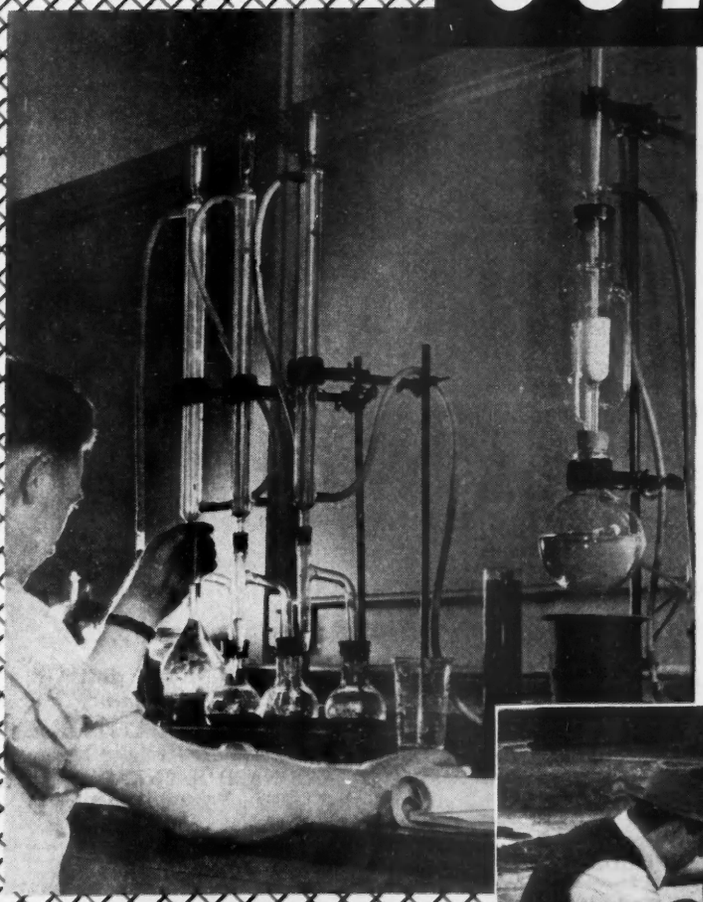

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DEHYDRATING DESALTING

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MODEL RIG—Karl Kellogg of K. L. Kellogg & Sons, California drilling contractors, was presented with a model rig by members of his organization. The present was a scale model of an actual drilling rig and stands just over seven feet high with a 17-inch base. The hoist is a three-shaft, two-speed model with a rotary table take off on the jack shaft. All drives are driven by chains and power is obtained through a reduction gear driven by an electric motor.

H. O. Woodruff has been appointed assistant division manager, Producing department, Pacific Coast division of The Texas Company. Woodruff joined the company as a roustabout in the Ventura district, and later worked in drilling operations at Eureka, Calif. In 1937 he was transferred to Signal Hill as assistant petroleum engineer, and in 1939 he became development engineer at Coalinga. He was made district engineer, Los Angeles Basin district, in 1942. As acting division engineer, he was transferred to Los Angeles in 1947. In 1948, Woodruff was named assistant to division manager.

»

J. G. Gilbert, head draftsman, Producing department, Pacific Coast division, has been appointed assistant to division geologist. **V. I. Coppard** suceeds Gilbert as head draftsman. Gilbert joined the company in 1929 as junior draftsman. Coppard started with The Texas Company in 1935 as draftsman.

»

G. G. Mason has been made director of Continental Oil Company's insurance division, succeeding **J. H. Johnson,** retired. Mason joined Continental in 1926.

»

William D. Maltman retired January 1 from active participation in the affairs of Franco Wyoming Oil Company and its associated interests. Waltman was a director and executive vice president of Franco Wyoming Oil Company, the parent organization.

Thomas E. Sunderland, general counsel of Standard Oil Company (Indiana), has been elected a director of the company. He fills the position on the board vacant since the death of **Buell F. Jones,** vice president and general counsel, in November of 1947.

Thomas E. Sunderland

Sunderland was appointed general counsel of Standard Oil Company (Indiana) in June, 1948. He went to Standard from the position of general counsel of its subsidiary, the Pan American Petroleum and Transport Company, New York. He joined Pan American in 1940. During World War II he served as a colonel in the Army Air Forces.

Sunderland succeed Jones as a director of Pan American in January of 1948 and is continuing in that capacity in addition to serving as general counsel and director of Standard Oil Company (Indiana).

»

J. A. LaFortune, executive vice president of Warren Petroleum Corporation, Tulsa, has been awarded an honorary degree of doctor of laws by the University of Notre Dame, of which he is a trustee.

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Capital Funds $9,106,248.33
Total Resources $137,375,756.57

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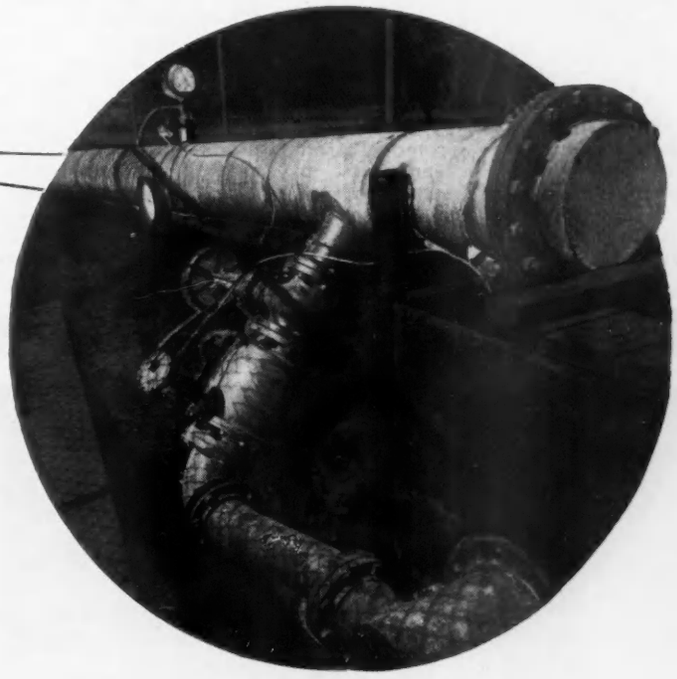
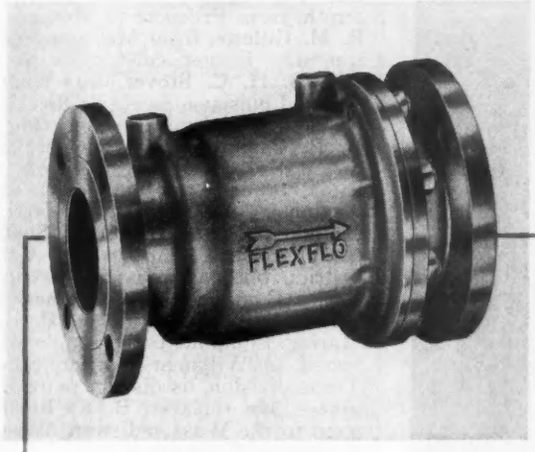
Flexflo maintains a fixed standpipe level



Nearly half-a-mile of 16-inch pipe carries waste water downhill from a gasoline plant to the disposal area. Before the installation of a Flexflo Back Pressure Regulator, rapid corrosion caused by the entrance of air during slack flow periods necessitated line replacement every year.



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Over 5 Years Without a Replacement

Grove Flexflo Back Pressure Regulator, installed on the lower end of a waste disposal line, keeps the line full. As waste salt water rises in the standpipe at the plant, discharge automatically takes place at the disposal point. Corrosion, which formerly required annual replacement of the line, is now eliminated — no new line has been installed in over five years.

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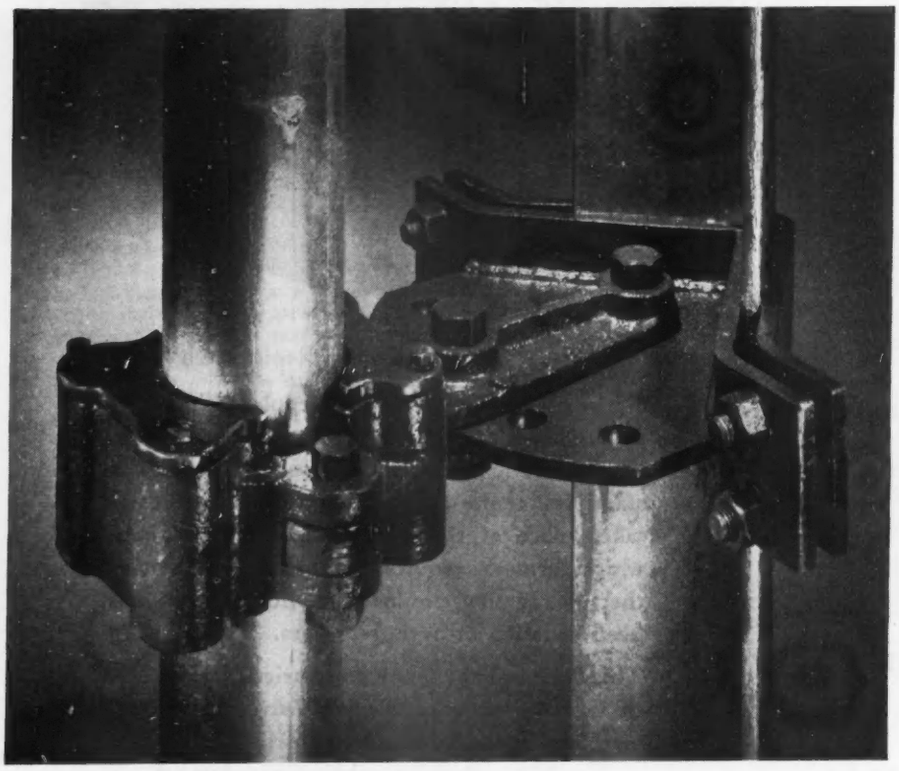
Transfers:

Richard T. Chapman, district geologist for Stanolind Oil and Gas Company, has been named a senior geologist in the Central division office at Oklahoma City, and has been succeeded at Shreveport by **Frank C. Osment. John C. Johnston** has been promoted from district geologist at Jackson, Miss., to division geologist at Casper, Wyo., and has been succeeded at Jackson by **Benjamin F. Baldwin . . . Hillard W. Carey,** head of the Production department of Houston Natural Gas Corporation, and **C. A. Nees,** chief production clerk; **W. H. Spencer,** geologist; and **Miss Sara Rich,** secretary to Carey, have been transferred to Corpus Christi. Production department offices, formerly in the Petroleum Building, Houston, have been moved to the Wilson Building, Corpus Christi . . . **Ralph E. Schneider,** petroleum engineer and geologist, has moved his headquarters from St. Louis to Roswell, New Mexico. He is manager of The Thirty-Six Oil Company and Vikar Company . . . **J. S. McKinstry,** superintendent of the discontinued Roanoke district, Louisiana division, Production department, of Humble Oil & Refining Company, has been transferred to the Paradis district, replacing **A. J. Chesney.** Chesney replaced **W. T. Dabbs** as superintendent of the Bayou Sale district, and Dabbs is now superintendent of the new Colorado City district, West Texas division. **F. L. Lively,** superintendent of the discontinued Bayou des Glaise district, became assistant superintendent of the Avery Island district, replacing **J. C. Andries,** who was transferred to North Crowley as assistant superintendent. **H. D. McClain** has been transferred from the Lovell Lake Pressure Maintenance Plant to the Opelousas Gas Plant, now under construction, as plant superintendent. He was replaced at Lovell Lake by **J. H. Kinsey,** former mechanical supervisor at Katy Gas Plant. Chief clerks who have been transferred are **A. M. Ferguson** from Bayou des Glaise to Bayou Sale; **J. A. Sizer,** from Bayou Sale to Grand Isle; **R. L. John,** from Roanoke to Livingston; **B. J. Groner,** from Livingston to Freeport; **R. L. Smith,** from Freeport to McCamey, and **R. M. Gillette,** from McCamey to Wasson. The former chief clerk at Grand Isle, **B. H. C. Stover,** was transferred to the Louisiana division office in New Orleans as assistant division chief clerk. **B. P. Cameron,** former chief clerk of the Marine Equipment division in Alabama, is now assistant chief clerk at Anahuac. **J. C. Gill** was transferred from Mallalieu to Hub and **O. A. Scott** went from Racoon Bend to the California district, both as assistant district chief clerks. **Campbell M. Carouthers,** senior petroleum engineer in the Production-Marine Equipment division, was transferred to Willamar district, Southwest Texas division, as district petroleum engineer. He replaced **B. K. Bevill,** who went to the Wasson district, West Texas division. **J. E. Graham** was promoted to district petroleum engineer at Grand Isle. **M. W. Bunch** was transferred from the Darrow district to the Louisiana division office as district civil engineer. **J. T. Lee,** civil engineer in the Louisiana division, was transferred to Kelsey as district civil engineer to replace **W. B. Burklin,** who was made district civil engineer of the Kelsey Gas Plant Construction district. **Clifton R. Crim,** district civil engineer, was transferred from Sunniland in Florida to the Thompsons Compressor Plant Construction district. Tool pushers who have been transferred are **E. W. Smith,** from Bayou des Glaise to Avery Island; **Wilson Black,** from Roanoke to Bayou Sale; and **J. E. Cox** from Freeport to the California district . . . **Vernon T. Tracy,** formerly division foreman of the Northern division of the Pan American Pipe Line Company, has been named division superintendent, with headquarters at Sabine, Texas. He replaces **H. W. Lambert,** resigned. **Milton Crow,** formerly district foreman in the Quitman district of the Northern division, succeeds Tracy. **S. L. Surratt,** formerly division gauger in the Southern division with headquarters at Alvin, Texas, has been transferred to Quitman as district superintendent. **Lee May,** who has been district gauger in the Pettus district, has been transferred to Alvin to succeed Surratt.

HERE'S SOMETHING NEW!



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MEN IN THE INDUSTRY NEWS

Dr. Theodore W. Evans has been appointed director of research for Shell Development Company. Evans will be in charge of the operation and research program of the company's Emeryville laboratories.

Dr. T. W. Evans

He joined the Emeryville staff in 1930 as a research chemist and was appointed an associate director of research in 1942. He has been manager of the Emeryville laboratories since 1947. He is succeeded by Bruno Stolley, former assistant manager of personnel for Shell Oil Company in New York.

»

Clifford B. Marshall has been elected to the board of directors of Standard-Vacuum Oil Company. Marshall has been general manager of the India division, which includes Pakistan, Burma and Ceylon, since 1944. He first joined the company in 1920 and since has marketed petroleum products in Madras, Calcutta and Bombay. During World War II, as assistant division general manager, he was instrumental in Standard-Vacuum efforts to furnish high-octane gasoline and petroleum products to U. S. and Allied air, ground and naval forces in India, Burma, Ceylon and some sections of China.

C. B. Marshall

G. F. Barnwell

George F. Barnwell has been appointed Exploration department manager of Standard-Vacuum. A petroleum geologist since 1925, Barnwell has been active in oil exploration operations in the U. S., Indonesia and New Zealand and spent five years in an advisory capacity with a Standard-Vacuum affiliate in The Hague. Before moving to New York, Barnwell had been exploration manager for Standard-Vacuum Petroleum Maatschappij, Stanvac's petroleum-producing affiliate in Sumatra. **Rufus T. Burton** has been named area manager for the India Marketing division.

»

Dr. Stanley J. Seeger, Dallas oil man, has been elected a director of the First National Bank of Dallas. Seeger is president of the Nebo Oil Company, Inc., and affiliated concerns and is a director of the Texarkana, Texas, National Bank. He is filling a vacancy on the First National Bank board resulting from the recent death of Edward T. Moore.

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Phone 62-1538

Fred A. Davies has been elected executive vice president of Arabian American Oil Company. He will assist **W. F. Moore,** president, in the direction of all phases of the company's operations. Davies has been associated with Aramco since the earliest days of the company's activities in the Persian Gulf area. A mining engineer and oil geologist, he was among the first to believe in the presence of oil in Saudi Arabia. Since 1947 he has been vice president in charge of production and exploration. Davies has also been elected vice president of Trans-Arabian Pipe Line Company. He will coordinate Aramco and Tapline government relations activities in the Middle East. Arabian American Oil Company will move its executive offices and certain departments of the company from San Francisco to New York. The company has under lease a new 21-story office building at 505 Park Avenue, where present activities in New York as well as departments being moved from San Francisco will be consolidated. The initial move from San Francisco contemplates the transfer of approximately 200 employes. The first of this group will reach New York in May, and the remainder will arrive by June 15.

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Lloyd A. Lynd, Bartlesville, Okla., has been elected a vice president of Cities Service Oil Company (Delaware). Lynd is at present also treasurer and director of Cities Service Oil Company, Empire Pipeline Company, Cities Production Corporation and Terminal Facilities, Inc., and a director and assistant treasurer of Cities Service Oil Company, Ltd. He has been with the organization since 1919 and was treasurer in 1941.

Lloyd A. Lynd

»

Bettye M. Bohanon has been appointed assistant secretary and assistant treasurer of Conorado Petroleum Corporation, a company recently formed by Continental Oil Company, The Ohio Oil Company and Amerada Petroleum Corporation for the purpose of foreign oil exploration.

Bettye M. Bohanon

Miss Bohanon has almost 19 years of experience in the oil industry. Starting her business career in 1930 as a secretary in the office of the California Oil Empire, she became executive secretary of the Central Committee of California Oil Producers in 1936. In 1941 she joined the staff of PAW as a production and priorities specialist.

After three years with the Petroleum Administration, Miss Bohannon became an assistant petroleum attache with the State Department and was stationed in Lima, Peru, from 1944 to 1946. After her return to the U. S. she joined the Washington office of the American Independent Oil Company and served as assistant secretary of Independent Tankships, Inc., a subsidiary of American Independent.

»

Raymond H. Crowe has resigned as pipe line construction engineer for Stanolind Pipe Line Company, Tulsa, to accept a position with Stone and Webster Service Corporation of New York, heading an engineering staff which will certify construction by Fish Engineering Corporation, Houston, of the Transcontinental Gas Pipe Line. He will make headquarters in Houston.

»

Ralph O. Dietler has been elected chairman of the board of Stanolind Oil Purchasing Company. Other officers and directors include **A. C. Sailstad,** president; **D. L. Wolfe,** vice president; **F. J. Ryan,** treasurer; **L. M. Jones,** secretary; **R. W. Boyd,** comptroller; **George C. Getgood,** assistant secretary; and **H. L. Crosby,** assistant treasurer.

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The Ratigan No. 214 Tubing Tong is new in design and much lighter in weight than previous Ratigan Tongs, yet has greater strength. It is perfectly balanced for fast, efficient work. Ratchet-like action helps to speed up the job of running tubing, and permits easy handling with maximum safety.

The No. 214 is strong and always in position to be put on the tubing. There is no latching or unlatching of any hinged members. The dies are held at the proper angle for taking a positive "sure-grip" instantly, and they can be changed in less than one minute. They simply slip into place and are held firmly in position by a lock nut.

This new tubing tong will take three sizes of jaws . . . 2", 2½" and 3". They also are easily and quickly changed by means of a quick-acting, automatic locking pin.

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J. R. McWilliams, executive vice president of The Carter Oil Company, Tulsa, has been elected president of the McKamie Gas Cleaning Company, which operates a plant for the extraction of sour gas adjacent to the McKamie-Patton pool west of Magnolia in Lafayette, Ark. Other officials elected at a meeting of the directors include **L. A. Sunkel,** vice president; **R. P. Ryan,** secretary; **A. V. Tanco,** assistant secretary; **J. R. Ice,** treasurer; and **J. H. Waddle,** manager.

»

James Doughty, R. L. Kirkwood and **J. A. Morgan** have formed a new corporation to be known as the Rincon Drilling Company. The company will operate drilling rigs in Southwest Texas and the Rio Grande Valley. Doughty was formerly vice president of Southern Minerals Corporation and was with that company 11 years. Kirkwood and Morgan are partners in Kirkwood & Morgan, Inc., with offices in Alice, Texas.

»

Edward C. McLean has been appointed manager of the Beacon Petroleum Company's new offices in Chicago. He was formerly district manager for the United Petroleum Gas Company of Chicago.

»

Arden E. Ross, Tulsa attorney, has joined the Legal department of Amerada Petroleum Corporation.

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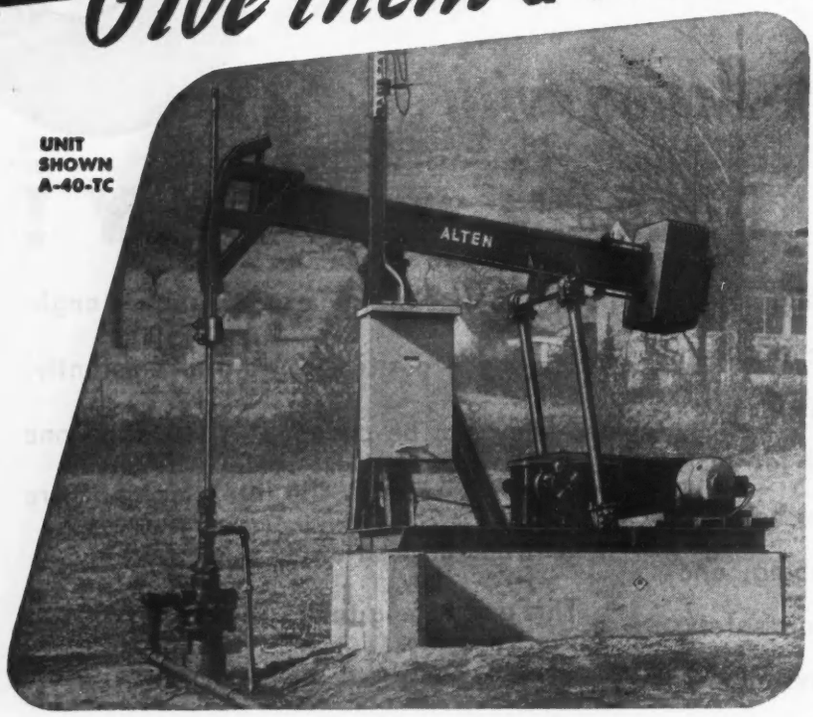

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Bouwe Dykstra

E. G. Robinson

E. G. Robinson, formerly New Orleans area manager for Shell Oil Company, has been appointed vice president in charge of exploration and production for Shell Oil Company of Canada, Ltd. **Bouwe Dykstra,** until now area manager at Midland, Texas, replaces Robinson in New Orleans. The new Midland area manager is **B. L. Ryan,** formerly land manager for Shell's regional office at Houston.

Robinson, a veteran of 24 years of Shell service, joined the company in 1925 as a geologist at San Antonio. Three years later he was transferred to Shell's office in St. Louis, where he was assistant to the vice president, exploration. After serving in California and Illinois, he was named, in 1943, manager of Shell's exploration activities in the Texas-Gulf area. In November, 1946, he became manager of the New Orleans area.

Dykstra joined Shell in 1926, in the Gulf Coast production department. In 1936, he was named chief exploration engineer at Tulsa. He was transferred to California in 1939, and the following year he went to South America as technical manager for Shell of Colombia Dykstra was named area manager at Midland in 1946.

Ryan, who joined Shell in 1920, became land superintendent in Dallas in 1924. In 1933 he was made land manager for the Gulf Coast region, and in 1947 was named regional land manager with headquarters in Houston.

»

Perry R. Bass

Perry R. Bass, Fort Worth oil man was elected a director of the Fort Worth National Bank at the annual shareholder's meeting. Bass is associated with **Sid W. Richardson** in the oil business and other enterprises.

A graduate of the Hill School at Pottstown, Pa., Bass received his bachelor of science degree from Yale University in 1937. He is a member of the Fort Worth Geological Society.

»

Charles G. Barndt has been appointed superintendent of distribution in Oklahoma for the Lone Star Gas Company and has established offices in Sulphur, Oklahoma.

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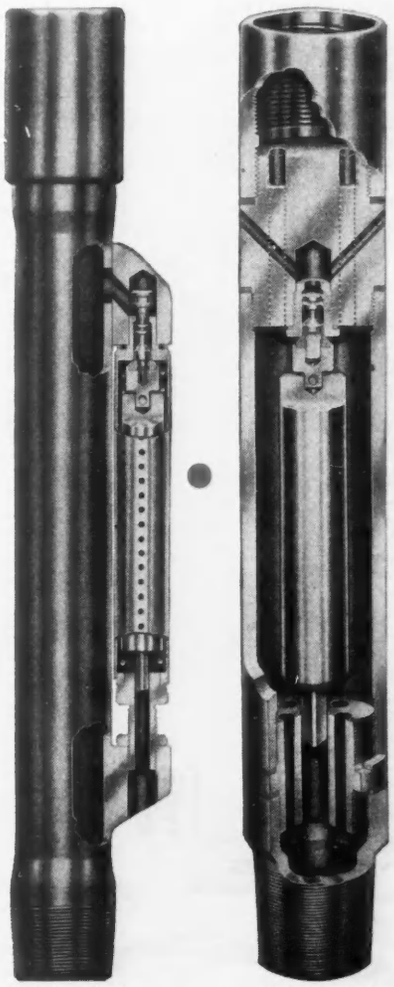

(Pat. Pending)

(Pat. Pending)

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BRANCH STORES: TEXAS—Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi, Columbus. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport, Houma. ARKANSAS—Magnolia.

Cloyes J. White, 49, Houston, division manager of The Texas Pipeline Company's basin system, died February 25 at Midland, Texas. He was in charge of the 24-inch pipe line being constructed from Jal, N. M., to Cushing, Okla. White had been with the company 20 years.

»

Lawrence C. Stelzle, president of Walter Motor Truck Company, died February 12.

»

John A. Van Wynen, former vice president of three Standard Oil Company (N. J.) affiliates, died February 18 at Glen Ridge, N. J. He joined Standard Oil in 1888 as junior clerk, and advanced to the vice presidency of Standard Oil Company of Pennsylvania, Stanco, Inc., and Pennsylvania Lubricating Company.

DEATHS

Eric Burkman, 56, secretary of U. S. Rubber Company, died February 26 at St. Thomas, Virgin Islands. Burkman was also secretary to the board of directors, the executive committee and the finance committee. He was a director of Latex Fibre Industries, Inc. of Beaver Falls, N. Y., and the Frank W. Gorse Company, Inc., both divisions of U. S. Rubber.

»

Elmer G. Diefenbach, 55, a pioneer in financing and developing some of the major natural gas transmission companies, died February 27 in New York City. He was a director of Panhandle Eastern Pipe Line Company.

Wilfred G. Lane, 64, a founder of Lane-Wells Company, died March 3 in Los Angeles. Retired since 1938, Lane, together with **Walter T. Wells,** organized the technical oil field service business to develop the gun perforator.

Wilfred G. Lane

Lane majored in electrical and mechanical engineering at Iowa State College. For 20 years he was employed by General Electric Company, and from 1929 to 1932 he was western district manager for Carboloy, Inc. In 1932 Lane and Wells began developing an electrically controlled gun which could be lowered into an oil well to perforate casing, and in December of that year they performed the first oil well gun perforating operation at Union Oil Company, La Merced No. 17 at Montebello, Calif.

»

J. M. Bradshaw, 54, Dallas, president of Hercules Oil Company, died February 28 in Tulsa. Bradshaw had been associated with the oil industry for more than 25 years.

»

Don R. Knowlton, 54, president of Old Ocean Oil Company, Houston, and head of the Knowlton Engineering Company, Oklahoma City, died March 9 in Oklahoma City. Knowlton, who was also president of the J. S. Abercrombie Company of Houston, was a wartime director of production for PAW.

Don R. Knowlton

Knowlton was with Marland Oil Company in California as petroleum engineer from 1924 until 1926, when he became district petroleum engineer for Phillips Petroleum Company. He was promoted to chief engineer, general superintendent and production manager.

»

Connor O'Neill, veteran Texas oil man, died February 28 in Wichita Falls. Formerly of Houston, O'Neill moved to Texas from Bradford, Penn., in 1903.

»

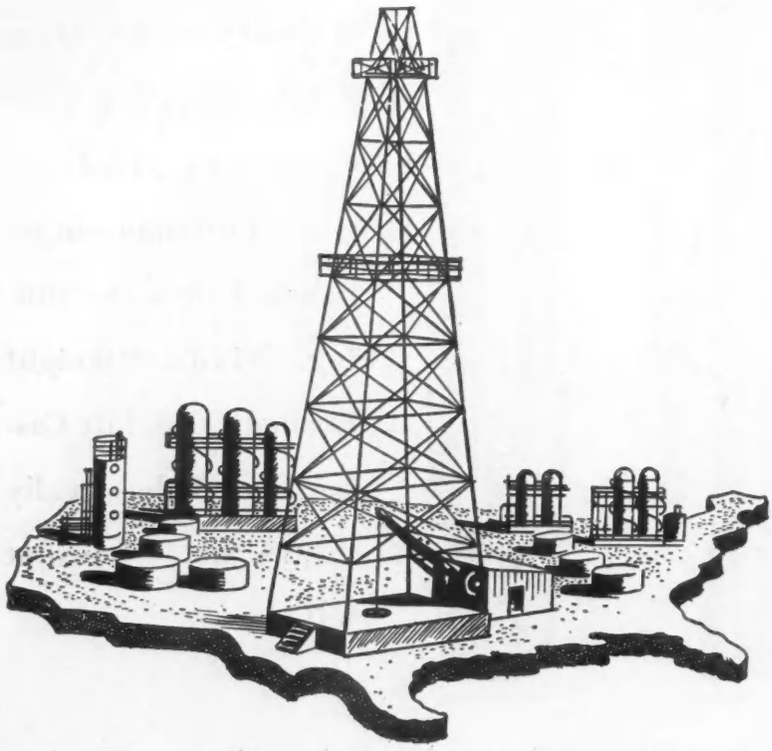
Chester A. Baltzell, 68, independent oil operator, Houston, died February 24 in Houston. He was formerly associated with the late Charles F. Farren, in Tulsa.

»

Prof. E. C. Baker, head of the mechanical engineering department of Oklahoma A. & M. College, died February 22 in Stillwater. He was a past president of the Mid-Continent section of ASME.

»

Haymon Krupp, 74, El Paso, Texas, pioneer independent operator who helped start development of University of Texas oil lands in West Texas, died February 21 in Rochester, Minn.



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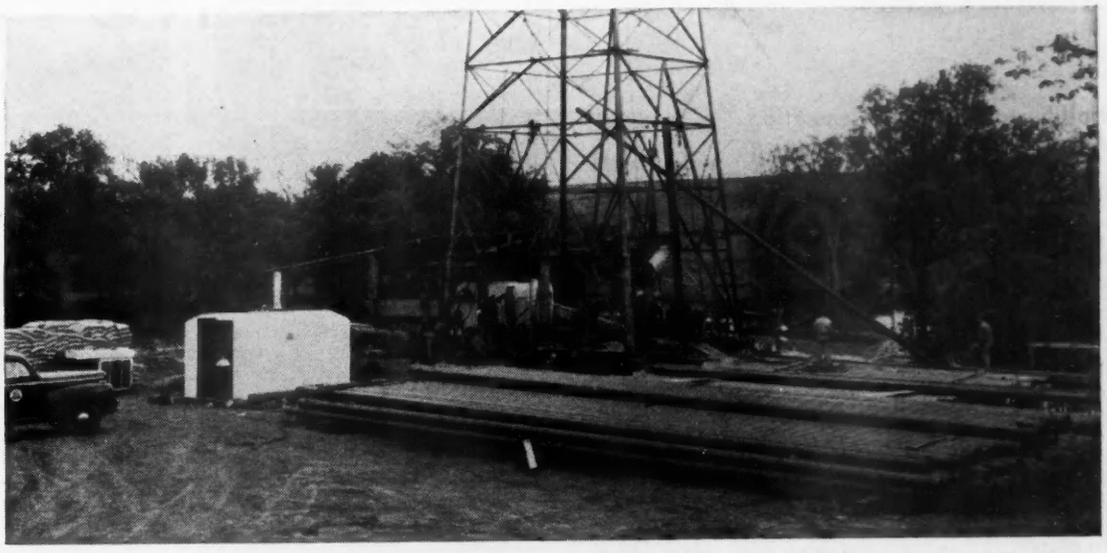

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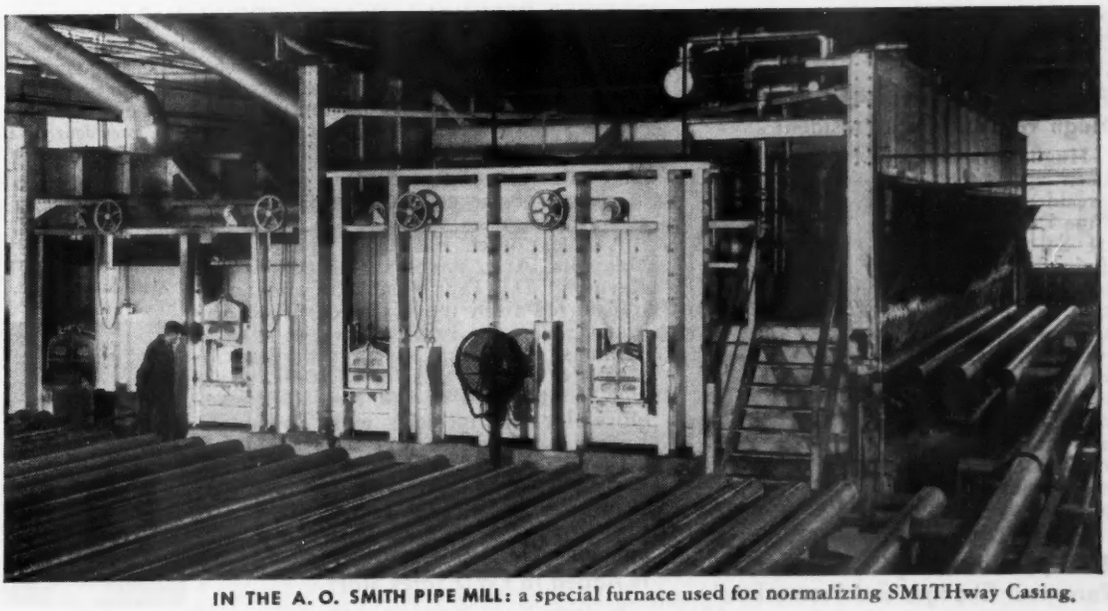

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EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Halliburton Oil Well Cementing Announces Transfers, Promotions

Hubert Northcutt, superintendent of the East Texas division of Halliburton Oil Well Cementing Company, has been promoted to bulk cement manager and transferred to Duncan, Okla. Chester Wimberly, superintendent of the South Louisiana division, has been transferred from New Orleans to Dallas. Ed L. Paramore, assistant superintendent of the South Louisiana Division, has been promoted to superintendent, with headquarters in New Orleans. P. A. Liston has been transferred from the Kansas division to be assistant superintendent in the South Louisiana division. Elmer Lawrence has been promoted to assistant superintendent of the Kansas division.

Fieldmen who have been transferred include Harold Wright, Flora, Ill., who has moved to Hays, Kansas. Dee Blevins, Alice, Texas, has been transferred to Marshall, Texas. Floyd Hamilton, Marshall, has moved to Alice. L. E. Denney, Corpus Christi, Texas, has been transferred to Refugio, Texas. F. C. Moody transferred to Corpus Christi from Refugio. J. L. Boatman of Falfurrias, Texas, has been transferred to Kenedy, Texas. R. A. Law of Kenedy has moved to Flora, Ill. Gilbert Knight has transferred to Falfurrias from Hays, Kansas. Russell Johnson, of Laurel, Miss., has moved to Great Bend, Kansas.

DRESSER OFFICIALS INSPECT KOBE PUMP—Dresser Industries, Inc., executives and directors fot a firsthand look at free pumping equipment during their recent visit to Kobe, Inc., and other Dresser subsidiary companies in California. Examining a typical free pump wellhead installation are, left to right, John B. O'Connor, executive vice president of Dresser; William A. McAfee and Prescott S. Bush, directors and members of Dresser's executive committee; C. J. Coberly, president of Kobe, Inc.; and H. Neil Mallon, president of Dresser.

Pipe Protection Firm Appoints Hugh W. Baird Vice President

Hugh W. Baird has been appointed vice president of Standard Pipe Protection, Inc., of St. Louis, Mo. Baird has had experience in the production, sales, protection and installation of pipe. Standard Pipe Protection, Inc., is a company recently organized to coat and wrap pipe up to 12½ inches in diameter, using new application techniques.

Hugh W. Baird

Black, Sivalls & Bryson Announces Personnel Changes and Promotions

Floyd C. Myers, regional sales manager for Black, Sivalls & Bryson, Inc., has transferred headquarters from the branch at Lubbock to Midland, Texas. He has been with the company 16 years.

John T. Cross, Jr., has been appointed branch manager at Hobbs, N. M. He was formerly at the company's branch at Odessa, Texas.

Benjamin W. (Bill) Bourne, sales engineer, has been transferred to the Midland sales office. Bourne was formerly in charge of the company's sales office at New Orleans.

A sales office has been opened at Magnolia, Ark., under the direction of Raymond D. (Dick) Canada, who has transferred from the Kilgore, Texas, branch.

James R. Banks has joined Black, Sivalls & Bryson as sales engineer, and will be stationed at the New Orleans office. He was formerly with Townsco Equipment Company at Oklahoma City.

C. W. (Bill) Hayes, engineer at Kansas City, Mo., has taken temporary charge of the New Orleans sales office.

Special Field Representative Is Added to FWD Sales Staff

Rodney Kox, formerly sales manager for the Family Life Insurance Company of Chicago, has joined the FWD sales staff as special field representative. Kox will work with FWD salesmen and distributors throughout the U. S.

Kox formerly was sales manager of the Western division of the American Mutual Liability Insurance Company of Boston and was manager of the Traveler's Insurance Company of Oak Park, Ill.

Cummins Sales & Service, Inc., Elects Everroad President

J. E. Everroad has been elected president and general manager of Cummins Sales & Service, Inc. He was previously vice president of the company, distributors of Cummins Diesel engines in the Mid-Continent area.

J. E. Everroad

Everroad started as a diesel engine mechanic with Mid-Continent Supply Company in Odessa, Texas, in 1936. Before he moved to the Southwest, he was connected with the Cummins Engine Company from 1932 to 1936 in Columbus, Ind., where he worked as a diesel mechanic and later as field service representative.

Cummins Sales & Service, Inc., with headquarters in Fort Worth, has recently completed two new factory-type Cummins Diesel engine repair shops at Odessa and Oklahoma City.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

R. W. Ard

G. W. Ferguson

Transfers and Additions Announced By Technical Oil Tool Corporation

R. W. Ard has joined the field engineering staff of Technical Oil Tool Corporation, Ltd., and will work with L. M. Williford and R. K. Palmer in the Oklahoma and Kansas areas. At present, Ard is working primarily in the Lindsay field, south of the Oklahoma City headquarters.

W. V. Oakes

G. W. Ferguson, Totco field engineer formerly at Lubbock, Texas, has been transferred to Abilene, Texas, W. V. Oakes, who recently joined the staff, will work under F. E. Siever in the West Texas and New Mexico districts, headquartering at Lubbock.

Raybestos-Manhattan Warehouse Is Established in Seattle

Raybestos-Manhattan, Inc. has established a warehouse and office at 314 Occidental Avenue, Seattle, Wash. Industrial rubber products for the industrial requirements of the Pacific Northwest area will be carried in stock.

The principal products carried will be conveyor belting, transmission belting, V-belts, industrial hose of all types, and asbestos and rubber packings.

Russell G. Heuman will be in charge of the Seattle warehouse and office, which is part of the West Coast Sales division. Littleton C. Barkley is general sales manager of the West Coast division, with headquarters at 131 Mission Street, San Francisco.

Manager Named for Ryerson Firm's Philadelphia Plant

W. A. Redpath has been appointed manager of the Philadelphia plant of Joseph T. Ryerson & Son, Inc., steel distributors, to succeed C. L. Hardy, who has been elected assistant vice president of the Ryerson organization, with headquarters in Chicago.

Redpath began his career with Ryerson in February, 1916, in the mailing department of the company's Chicago plant. He was appointed Chicago city sales representative in 1927, and promoted to assistant manager of sales, Chicago plant, in 1945. He remained in this position until his recent appointment.

Picture of a "Plus"...

Another reason *why* POWERFLEX retains Rotary Hose Leadership

The new couplings on Thermoid's Powerflex will not leak or pull loose for the life of the hose.

The higher the pressure, the tighter the seal . . . integral construction of coupling and hose prevents hose breakage behind the coupling, *and every length is pre-tested to 5000 psi.* The new forged steel coupling is only ½ the weight of the former coupling and it is the same approximate diameter as the hose end.

For safety, dependability and economy . . . Specify Thermoid Powerflex Rotary Hose.

POWERFLEX *now available in 3" and 3½" with the new couplings having 4" API male threads. 2½" (3" API threads) coming soon.*

It will pay you to ***Specify*** Thermoid!

Thermoid Quality Products: Oil Country Flat Belting • Wire Line Turn Backs • No-Wip Line Savers • Stuffing Box Rings • All types of Hose • Molded Specialties • Powerflex Rotary Hose • Mud-Flo Slush Pump Hose • Flexible Discharge Units • Brake Blocks • F.H.P. and Multiple V-Belts.

Thermoid Company

Western Offices and Factory • Nephi, Utah, U.S.A.

Main Offices and Factory • Trenton, N. J., U. S. A.

Industrial Rubber Products • Friction Materials • Oil Field Products

Jet Perforating Service Will Serve Oil Industry in Venezuela

The introduction of jet perforating in Venezuela has been announced by Seismograph Service Corporation of Delaware and Welex Jet Services, Inc., with the completion of a jet perforating job in Venezuela's Saban field, near Tucupido. The two companies are participating in this service through Seismograph Service Corporation of Delaware with headquarters in Caracas, Venezuela.

For the past several years Seismograph Service Corporation of Delaware has been providing Hayward mudlogging service and gamma ray and neutron (radioactivity) well logging service to the oil industry in Venezuela. The jet perforating service and the radioactivity well logging are complementary inasmuch as both operations may be carried out from the same base camps, use the same personnel, use the same hoist truck equipment and the same cables.

Seismograph Service Corporation and Welex Jet Service, Inc., plan to expand the mudlogging, radioactivity and jet perforating services in Venezuela. The technical experts of both companies are in Venezuela determining what the requirements of the industry are and arranging for necessary equipment and personnel.

Now
Acme
Cable Tools
TRUSTWORTHY SINCE 1900
Rope Socket Ruggedness of Half-Century Repute
It's what goes under a drilling tool's surface finish that REALLY counts—down hole. Acme Rope Sockets, remember, have those EXTRA inner-rugged qualities which pay off, in bonus service.
Their every maximum field-service factor is safeguarded, from billet to finished Socket: By our own rigid specifications for PREMIUM-grade steel . . . electric-automatically controlled heat-treatment process . . . master-craftsmanship, to engineered exactness.
Prosser Swivel Socket (Fig. 115) is used on wire cable . . . as are our Babcock (stiff) and Burns Swivel. (Other types for manila cable.) All made to API specifications — unless "special."
Acme's Rope Sockets MUST uphold their 2-generation REPUTATION—for greater stamina and trustworthy performance: "Down-deep" factors that cut drilling cost foot-by-foot . . . Tool-making factors beyond any "stop-watch" limitations.
ACME
Fig. 115 Acme Prosser Swivel Socket
See Acme's latest Catalog and Manual in Composite Catalog (Vol. 1). Or mail penny postal TODAY for your copy . . . chockfull of valuable information for every Cable Driller.
See other Acme Drilling Tools in panel (right) . . for more of EVERYTHING you need in a Trustworthy String.
More of EVERYTHING You Need in an Acme String . . .
A
B
C
D
E
F
A—Wire Line Clamp, 12"
B—Prosser Swivel Socket
C—Drilling Jar
D—Drilling Stem
E—Bailer
F—Drilling Bit
Acme Fishing Tool Co.
PARKERSBURG, W. VA.
Export Office: 19 Rector St., New York 6, N. Y.
ACME DRILLING & FISHING TOOLS
Since 1900

Hughes Tool Appoints Assistant To Vice President-Engineering

Lyle L. Payne

Lyle L. Payne has been appointed assistant to Daniel J. Martin, vice president - engineering of Hughes Tool Company. Payne will assist in obtaining a closer coordination of sales, engineering and manufacturing activities from the research and engineering points of view.

Cooper-Bessemer Gets Compressor Contract for Transcontinental Line

The Cooper-Bessemer Corporation has been awarded contract for the construction of 21 new-type "Turboflow" gas engine driven compressors for Transcontinental Pipe Line Corporation's proposed 30-inch carrier. The contract represents authorization to build 70 percent of the gas engine drive equipment required for Transcontinental's 1949 construction program.

The Transcontinental line will deliver 500 million cubic feet of natural gas each day from the Gulf-Texas sectors over a distance of 1840 miles to the terminus on the east bank of the Hudson River, New York City. Gas deliveries will be made primarily to distributors presently engaged in the production and distribution of manufactured gas.

Construction of the pipe line alone will require 470,000 tons of steel. Based on present deliveries of pipe, Transcontinental believes its line will be completed by the early part of 1951. Construction of the huge Cooper-Bessemer "Turboflow" units is to begin at once for completed delivery well in advance.

Eagle-Picher Names Vice President And General Manager of Insulation

Clyde B. Lynde has been appointed vice president and general manager of the Insulation division of The Eagle-Picher Sales Company, with headquarters in Cincinnati.

Clyde B. Lynde

Lynde began his business career in 1919 with the United Iron Works, Inc., and was headquartered at Dallas. In 1933, Lynde joined The Eagle-Picher Company as Joplin insulation district manager and head of the Insulation Contracting department of that company. He served in both capacities for more than ten years, when he resigned to go into the insulation contracting business for himself in an organization known as Industrial Insulators, Inc., distributing and applying Eagle-Picher insulations in the Houston area.

The Southwest's Leading
OIL BANK

First National Bank in Dallas

1st NATIONAL

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

BARCELONA
Now included in KLM's Great Oil Network...

★ ARUBA
★ CURACAO
★ CARACAS
★ MARACAIBO
★ BARCELONA

Now Barcelona, Venezuela joins the other great Caribbean oil centers served by KLM's famous *Royal Route from Miami.*

Leave MIAMI any TUESDAY or SATURDAY evening at 11:00 P.M. . . . lunch in Barcelona the next day!

		Tues., Thurs., Sat. CONSTELLATION	Tues., Thurs., Sat., Sun. DC-4
LV....	MIAMI	08:15	23:00
AR..	ARUBA	14:55	07:10
AR..	CURACAO	16:20	08:35
AR..	MARACAIBO	16:40	08:45
AR..	CARACAS	16:45	09:10
AR..	BARCELONA		Wed., Sun. 11:30

K·L·M ROYAL DUTCH AIRLINES
1919 30TH YEAR 1949

THE WORLD'S FIRST AIRLINE TO ACHIEVE ITS 30th ANNIVERSARY

SEE YOUR LOCAL TRAVEL AGENT or KLM Royal Dutch Airlines, 572 Fifth Ave., New York, N. Y. LU 2-4000; 308 N. E. 1st Street, Miami 3-8455. Other KLM offices in Los Angeles, San Francisco, Chicago, Washington, Boston and Montreal.

INSWELL
DOUBLE-DUTY
STEEL CHAIN

WHAT DO YOU ASK FOR IN CHAIN?

SAFETY to men and materials?

LONG SERVICE LIFE under exposure to abrasion and weather?

ECONOMY in first cost or "services rendered?"

EASE OF HANDLING by reason of non-kinking, short link design?

● **SPECIFY INSWELL**

Double-Duty High Test Chain and you have *all* of these advantages working for you. Our best customers are those who gave Double-Duty Chain the "on-the-job" test.

WRITE US *for the name of the distributor nearest your office or field operations.*

COLUMBUS McKINNON
CHAIN CORPORATION
(Affiliated with Chisholm-Moore Hoist Corp.)
GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.
SALES OFFICES: New York • Chicago
Cleveland • San Francisco
Other Factories at Angola, New York,
St. Catharines, Ontario and Johannesburg, S. A.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

ROCKWELL OFFICIALS MEET—A three-day conference of division managers of Rockwell Manufacturing Company was held at the Schenley Hotel in Pittsburgh to discuss plant operating statements and annual budgets as tools of operating management. Shown are 30 members of the firm who attended the meeting, W. F. Rockwell, chairman of the board; W. F. Rockwell, Jr., president; L. A. Dixon, A. J. Kerr, J. E. Ashman, W. H. Newbaker, E. W. Meyers, W. S. Potter, C. A. Wiken, M. J. Carl, C. S. Bygate, W. H. Marsh, E. F. Foubert, H. C. Greene, Munroe Corbin, R. G. Caouette and S. W. Brown of Pittsburgh; A R. Whittaker, National Meter, Brooklyn; H. F. Zorn, V & O Press, Hudson, N. Y.; W. R. Brown, Arcade Manufacturing, Freeport, Ill.; R. C. DuBrucq, Crescent Machine, Leetonia, O.; F. V. Snodgrass, Nordstrom Valve, Oakland; H. C. Stuckeman, R. P. Melius, Delta Manufacturing, Milwaukee; W. F. Crawford, W. A. Marsteller, Edward Valves, East Chicago, Ind.; H. S. Rockwell, Hopewell division, Hopewell, N. J.; H. F. Sacknus, Red Star Products, Norwalk, O.; L. W. Heavner, Macnick division, Tulsa; L. A. Dixon, Jr., Pittsburgh DuBois, DuBois, Penn.

Oil Well Supply Establishes Ohio-West Virginia District

Another district in the Eastern division of Oil Well Supply Company, to be known as the Ohio-West Virginia district and comprising the former Ohio and West Virginia-Eastern Kentucky districts, has been established.

H. C. Wright, district manager for the Ohio district, has been named manager of the new district, with headquarters at Charleston, W. Va. R. W. Pittman, formerly manager of the West Virginia-Eastern Kentucky district, has transferred to the production planning and procurement department at "Oilwell's" headquarters in Dallas.

Wright has been associated with "Oilwell" more than 25 years. After serving in various branch stores in the Eastern division, he was appointed manager of the Ohio district in January, 1944.

Pittman joined Oil Well Supply Company in July, 1936, at the Monahans, Texas, store. He also was connected with several stores in Illinois, and became manager of the West Virginia-Eastern Kentucky district in May, 1943.

Lane-Wells Company Transfers Three Division Sales Engineers

J. Murray Walker, former division sales engineer at Tulsa for Lane-Wells Company, has been assigned to the head office at Los Angeles as export sales engineer. He will assist in handling foreign trade.

Replacing Walker in the Tulsa sales office is S. W. McGaha, formerly division sales engineer-geologist with the Mid-Continent division office in Oklahoma City.

John M. Terry, formerly district sales engineer in the Lane-Wells Pampa subdistrict, has been promoted to division sales engineer and assigned to the Mid-Continent division office.

PELCO
Welding Saddles
Specify PELCO
IMMEDIATE DELIVERY
OUTLET (OR NOZZLE) SIZES ¼" TO 16"
HEADER (OR LINE) SIZES UP TO 36"
Order Through Your Favorite Supply House
PELICAN WELL TOOL & SUPPLY CO.
P. O. Drawer 1108 Shreveport (84), La.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

St. Louis and Jacksonville Offices Are Opened by Chain Belt Company

Chain Belt Company of Milwaukee has opened new district sales offices in St. Louis and Jacksonville, Fla.

The new St. Louis office is located at 8001 Clayton Road, and will be under the direction of Clarence R. Studer, district sales engineer. Studer was with

C. R. Studer

D. B. Hill

Chain Belt Company in the St. Louis area for four years before his appointment as district sales engineer. He was formerly with General Electric Company for 19 years, as application and sales engineer.

The Jacksonville office, at 340 West Church Street, will be under the direction of David B. Hill. Hill joined Chain Belt Company in 1937 and was district sales engineer in its Chicago and Atlanta offices prior to his appointment as district manager at Jacksonville.

Paschall Named South American Representative for H. C. Smith

Hearn J. Paschall was named exclusive representative for H. C. Smith Oil Tool Company throughout South America. Paschall will make his headquarters in Caracas, Venezuela. He has been associated with the firm for 11 years and during the past year was the company's division manager for Mississippi.

Hearn J. Paschall

Two years ago, Paschall made an extensive tour of the various oil fields throughout the Middle East for his company.

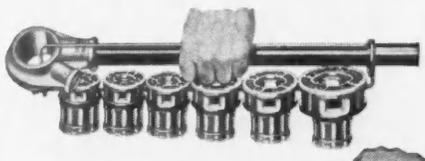
National Tube Company Gary Works Superintendent Is Appointed

Walter A. Jayme has been promoted to general superintendent of the Gary Works of National Tube Company. He has been assistant general superintendent of the plant since 1947.

Jayme has been associated with U. S. Steel subsidiaries 14 years, serving Carnegie-Illinois Steel Corporation in various capacities before joining National Tube. Four years ago he was made director of research and development of the company's war rocket project, and as assistant to general superintendent at Ellwood City, Penn., before transferring to Gary, Ind.

Now it's a Cinch

TO THREAD SMALL PIPE



Free handy carrier for any group of sizes.

RIDGID Ratchet Threaders No. 00R, 111R and 12R are extra handy for 1/8" to 2" pipe

● Light strong efficient RIDGID ratchets give you perfect threads on 1/8" to 2" pipe — fast, without bothersome get-ready. Precision cut tool-steel dies. Die heads snap into ratchet ring from either side, can't fall out. You don't need special dies for close-to-wall threads. No. 00R, 1/8" to 1" pipe; No. 111R, 1/8" to 1¼"; No. 12R, 1/8" to 2." Conduit dies furnished on request. Buy these handy work-savers at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

United Geophysical Company, Inc., Announces Personnel Promotions

Norman J. Christie has been appointed area supervisor of United Geophysical Company, Inc., for the Mid-Continent and Gulf Coast division, with headquarters in Tulsa.

Wayne H. Denning has been named area supervisor for the California and West Coast division, with headquarters in Pasadena, Calif. Denning spent seven years, from 1940 through 1947, in Brazil in charge of United's activities in that country. He was later in charge of United's geophysical activities in Puerto Rico.

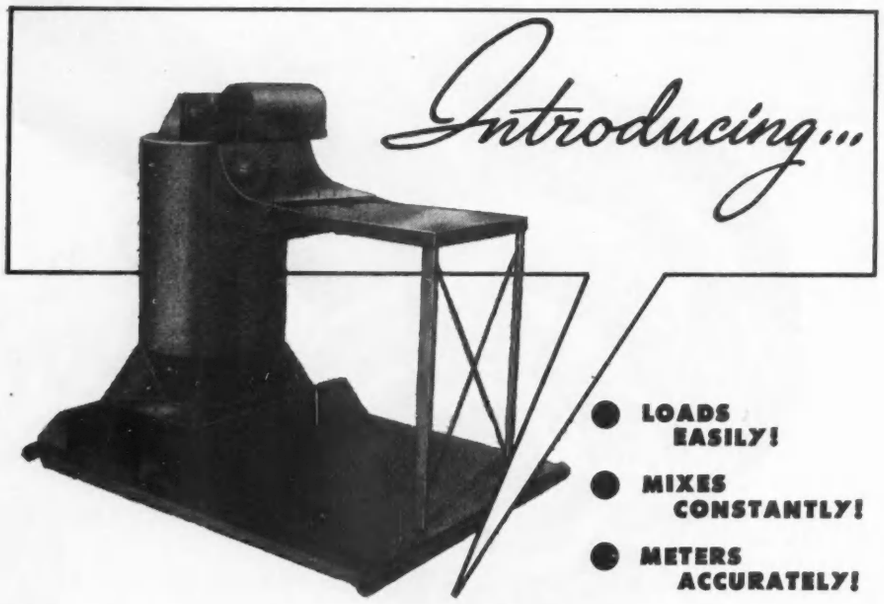
R. A. Pohly has joined the gravity division as gravity supervisor for the Mid-Continent division. Pohly will headquarter in Terre Haute, Ind. During 1942 and 1943, Pohly was in Venezuela in charge of a gravity crew working in the western Llanos area.

C. C. Lister has been appointed manager of foreign operations. He was transferred to Brazil in 1940, and in 1944 was transferred to Colombia as supervisor in charge of Colombian operations. In 1947 he went to Venezuela as vice president in charge of Venezuelan and Colombian operations. Lister will temporarily make his headquarters in Caracas, Venezuela, and at a later date will headquarter in Pasadena, Calif.

Lincoln A. Martin has been appointed manager supervisor of Venezuelan operations for United Geophysical Company, S. A. He will headquarter in Caracas. Herbert Hoover, Jr., president of the company, is in Venezuela inspecting United's operations in that area.

K. A. Robertson has been appointed vice president of the United Geophysical Company of Canada and will make his headquarters in Calgary, Alberta. He also is area supervisor of the Canadian and Rocky Mountain division of the United Geophysical Company.

Wayne A. Phares has been named area supervisor for gravity operations of the United Geophysical Company of Canada. Phares will headquarter in Calgary.



THE EMPIRE METERING MUD MIXER!

DRILLING MUD SAVER DELUXE

This Mud Mixer, with patented METERING outlet, is like money in the bank! Drilling contractors will find it cuts mud mixing time at the well, for a faster job with more profit! The Empire METERING Mud Mixer is light . . . easy to hook up and move . . . made for AC or DC current. It eliminates mud pit settling of expensive drilling mud . . . accurately controls the AMOUNT of mud used . . . cuts drilling time and fishing jobs . . . puts a better coating in the well . . . and costs only $660.00!

A POSITIVE MUD ECONOMIZER

WRITE FOR COMPLETE DESCRIPTION

Big Four Machine & Tool Company Buys Murray Shop at Pawhuska

Big Four Machine & Tool Company, Clay City, Ill., has purchased the Murray Tool & Supply Company shop at Pawhuska, Okla., from the Kerr-McGee interests. The new firm will be known as the Big Four Machine & Supply Company of Oklahoma.

John R. Riley

The shop will continue the repair of oil field equipment and will also manufacture the same line of products as the Clay City plant, including portable drilling rigs, goosenecks, drill pipe floats, hydraulic wall hooks, and slim hole swivels.

John R. Riley, president of Big Four, was a small boy living in Indian Territory when oil was discovered at Alluwe in 1903. In 1920, he joined Oil Well Supply Company at Pawhuska and was later with American Iron and Machine Works. With G. C. (Red) Ross, also an American Iron representative, Riley purchased the Brauer Machine & Supply Company in Clay City in 1941. The name was changed to the Big Four and the following year the two bought all patents and patent rights from Brauer.

Herbert A. Koch Named Head of Dowell's Fort Worth Office

Herbert A. Koch, general sales engineer for Dowell Incorporated in Tulsa, has been named head of the company's Fort Worth office. He will be sales coordinator in the Fort Worth-Dallas area with special responsibilities throughout Texas, Louisiana and New Mexico.

Koch, a graduate of the University of Oklahoma, has been with Dowell since 1944, originally as district engineer in Oklahoma City and Seminole. A member of the AIME, he has received special training with Dowell in Electric Pilot services.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Norma-Hoffmann Bearings Names E. J. Schmiel and R. O. Wirtemburg

Erwin J. Schmiel and Ralph O. Wirtemburg were appointed secretary-treasurer and sales manager of the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Schmiel succeeds Edward C. Lennon,

E. J. Schmiel

R. O. Wirtemburg

who is retiring after 35 years of service. Schmiel was general auditor of the Elastic Stop Nut Corporation and for 20 years prior to that position was a member of the New York firm of Fedde & Company, certified public accountants.

Wirtemburg succeeds Frederick W. Mesinger, resigned. Wirtemburg was formerly eastern regional sales manager of the New Departure division of General Motors. He is an engineering graduate of the University of Cincinnati.

W. C. Beadle Becomes Acidizing Manager for Western Company

Walter C. Beadle has been appointed manager of the acidizing department of The Western Company.

Beadle has been with The Western Company for five years. He was formerly the manager of Western's south district in Odessa. He will be located in the company's general offices in Midland.

Walter C. Beadle

Other promotions: J. S. Caffrey to manager of the south district, Frank Turner to station manager at Odessa, and C. E. Smith to manager at Levelland.

Diamond Chain Names Distributors In Boston, Chicago and Detroit

Chase, Parker & Company, Inc., 288-290 Congress Street, Boston, has been appointed distributor for the Boston area by Diamond Chain Company, Inc., of Indianapolis, makers of roller chains, sprockets, flexible couplings, and conveyor chains.

Apex Power Equipment Company, 4047 West 26th Street, and Ray M. Ring Company, 1234 Washington Boulevard, have been named distributors for Chicago. The company has named W. F. McGraw & Company, 575 East Milwaukee Street, Detroit, as the distributor for that area.

Compare FALCON Quality

MORE HOURS OF SERVICE IN FALCON SLUSH PUMP PARTS

Quality vs. Price . . .

In dealing with the toughest pumping job on earth — the movement of highly abrasive muds under extremely heavy pressures, FALCON has concentrated its every resource on building pump parts that will outlast all others.

When it comes to price, it's the cost per hour of slush pump operation that counts. COMPARE FALCON PRODUCTS for long-lasting durability. Make your own test right on the job. Install FALCON Liners, Pistons, Rods and Packing on one side of your slush pump. Install identical parts of any other make on the opposite side. After a period of the hardest usage, check the results and make your own comparison.

• *Sold only through leading supply houses everywhere.*

FALCON PRODUCTS, INC.
POMONA CALIFORNIA

WAREHOUSES • HOUSTON, TEXAS 1802 Maury Street
ODESSA • WICHITA FALLS • OKLAHOMA CITY
JEANERETTE, LA. • CASPER • RANGELY • BAKERSFIELD & AVENAL, CALIF. • TURNER VALLEY, CAN.
Export Representative: Guy E. Daniels, 30 Rockefeller Plaza, New York 20, N. Y.

National Tube Company Installs New Doughnut Furnaces at Gary Plant

An even baker's dozen of new doughnut-shaped furnaces have been installed in National Tube Company's Gary, Ind., mill to heat pierced seamless steel tubes to high enough temperature so they can be rolled to specified size. Tube sections fly through the holes of the 13 doughnuts as fast as 240 feet a minute, emerging at the end, ready for rolling, at a temperature of 1800° F.

The doughnut-type furnaces are used in conjunction with a huge rotary billet heating furnace and represent a major part of the modernization and rebuilding program recently completed at the Gary mill. Other new facilities under construction or planned at this U. S. Steel mill include an additional seamless tube mill of advanced type.

Ideco Opens Store

E. E. Keating has been appointed store manager of a new International Derrick & Equipment Company store at Hays, Kansas. The installation will be operated under the direction of the Kansas district manager, R. R. (Lefty) Matthews.

SPECIFY
SPANG
FOR THE BEST IN CABLE TOOLS
SPANG
CENTER ROPE SPEAR
(Fig. F460)
THREE-PRONG GRAB
(Fig. F467)
Fig. F460 Fig. F467
THE HIGHER STANDARD
For fishing broken cable and sand line, Spang furnishes a variety of Center and Side Rope Spears, as well as Two- and Three-Prong Grabs.
Strands of cable left attached to the rope socket may be removed with the Spang Drill Mill, or the Spang Drive Down Socket or Trimmer.
For the best in Cable Tools,
SPECIFY SPANG
SPANG & CO.
BUTLER, PA.
YOUR DEALER SELLS SPANG TOOLS

Walter Brown Is Appointed Chief Engineer for Brewster Company, Inc.

Walter Brown has been appointed chief engineer of The Brewster Company, Inc., Shreveport. Brown was formerly assistant chief engineer. He will be in charge of the design and mechanical engineering for all Brewster matched drilling equipment.

Walter Brown

A member of the American Society of Tool Engineers, Brown holds a master's degree in mechanical engineering from the University of Vienna. Associated with the oil and petroleum suppliers industry for 20 years, Brown has invented and developed a number of devices now used in pipe line and drilling equipment.

Totco Service Engineer Visits European, Eastern Oil Companies

R. B. Paddock, service engineer of Technical Oil Tool Corporation, Ltd., left New York to visit oil company offices in Europe and oil fields of the Near, Middle and Far East. Objective of the trip, expected to require eight months, is to inspect and test all Totco equipment for controlled vertical drilling in use in the fields and to advise on maintenance and replacement of equipment, much of which has been in operation since before World War II.

R. B. Paddock

Paddock will be at the service of oil company engineers for consultation on the application and extension of controlled vertical drilling in each area.

Stohr Is Named General Manager Of Allis-Chalmers Norwood Works

Frank H. Stohr has been named general manager of the Allis-Chalmers Manufacturing Company's Norwood Works. Stohr was formerly executive vice president and a director of the Elliott Company, of Jeannette, Penn. He succeeds R. W. Davis, general manager of the plant since 1944. Davis, who has been a member of the Allis-Chalmers organization for 40 years, will continue in an advisory capacity to the general manager.

Stohr was graduated from the University of Iowa in 1922 as an electrical engineer. After graduating, he joined Westinghouse Electric Corporation. He became manager of various electrical sales, engineering and production departments, and in 1939 he was made manager of the industries sales division. In 1944, he went to the Elliott Company as assistant to the president.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Link-Belt Company Names Export, Enclosed Drives Sales Managers

Roy E. Jones, formerly assistant export manager of Link-Belt Company, has been appointed export manager, with headquarters in New York City. He succeeds Carl A. Woerwag, retired.

Roy E. Jones

Jones, a mechanical engineering graduate of the University of Pennsylvania, joined Link-Belt at the Philadelphia plant in 1927. After seven years in engineering, estimating and design work, and one year in general sales, he was transferred to domestic-sales at the New York office in 1935. He has worked on export sales since 1941, and was made assistant export manager in 1944.

Link-Belt Company has appointed J. H. Oakes sales manager, enclosed drives, with headquarters at the company's Philadelphia plant. He will be assisted by Harry F. Kurz as representative, enclosed drives, with headquarters at the Pershing Road plant in Chicago.

Oakes worked part time in various manufacturing departments of the Link-Belt Dodge plant, Indianapolis, from 1922 to 1929, and in the San Francisco plant engineering department. After completing his education at Hanover College and Purdue University, Oakes entered the full-time employ of the Dodge plant experimental department in 1929. He has served as application engineer, assistant divisional sales manager, and divisional sales manager.

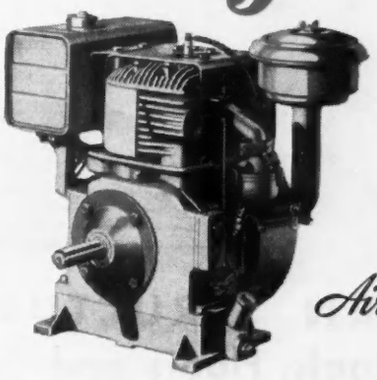
Kurz joined Link-Belt in 1935 at the Philadelphia plant, where he worked in the balance of stores, order, engineering and sales departments. Until his present appointment he was divisional sales manager, enclosed gear drives, at Philadelphia.

Seldon A. Stone Joins Ideco Eastern Sales Organization

Seldon A. (Rocky) Stone, formerly Eastern sales representative for Bucyrus-Erie Company, has joined International Derrick and Equipment Company to become Eastern drill sales manager. Stone started in the oil field equipment business with Parkersburg Rig & Reel Company in 1934. He later joined Continental Supply Company as field service representative, and in 1939 became field representative for the Franklin Supply Company. In 1941 he joined the Drill Sales division of Bucyrus-Erie. He will have sales headquarters at the Ideco plant at Marietta, Ohio.

S. A. Stone

It will pay you to select Briggs & Stratton Engines



"Preferred" Air-Cooled Power

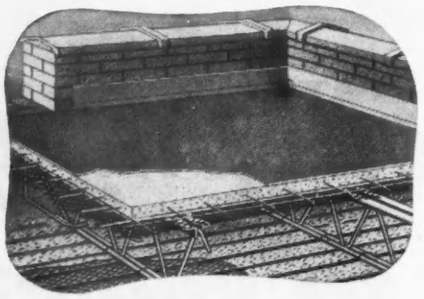
You'll get *top* performance from your equipment when you choose Briggs & Stratton as your gasoline power!

Here's why. Briggs & Stratton engines give you the advantages of the most modern 4-cycle, single-cylinder, air-cooled design—the result of over 30 years of continuous research and production. They're precision-built of finest materials. They're strong, tough, durable. They cost less to operate.

That's why users and dealers ask for Briggs & Stratton power when they want gasoline powered equipment, appliances or machinery. That's why Briggs & Stratton powered equipment is easier to sell—and preferred power to own. Choose Briggs & Stratton engines for your requirements. They're today's outstanding power value.

BRIGGS & STRATTON CORP., Milwaukee 1, Wis., U. S. A.

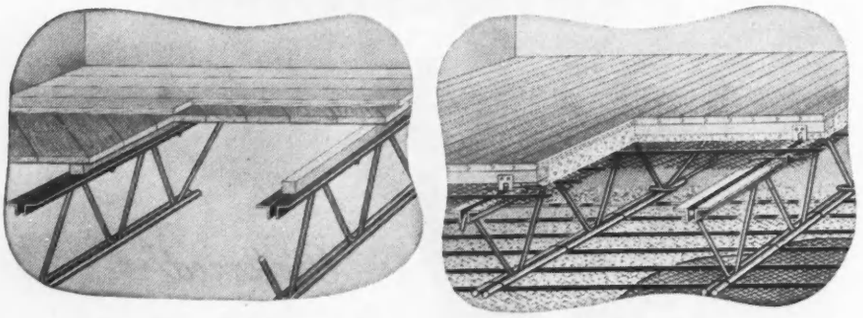
4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES
World Wide FACTORY SUPERVISED SERVICE



SHEFFIELD

OPEN WEB

STEEL JOISTS



THE MODERN STRUCTURAL

For Supporting Roofs, Floors and Ceilings

The architect's renditions above show you how readily Sheffield Steel Joists are adaptable to the application of most any type roof, floor or ceiling.

When used to carry various designs of concrete slab and plaster ceilings, they have as much as a 4 hour fire rating and eliminate the dangers of twisting, sagging, shrinkage, decay and attack by termites and rodents.

Light in weight, Sheffield Joists are easier to install. No false-work or shoring is required. They enable designers to effect other economies throughout an entire structure. A wide selection of span lengths up to 40′ clear span and joists types, from 8″ to 20″ depths, simplify design problems.

Write today for brochures giving latest details and showing how widespread Sheffield Steel Joists are used in all types of buildings.

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HOUSTON KANSAS CITY TULSA

SALES OFFICES: Chicago, Ill.; St. Louis, Mo.; Des Moines, Ia.; Omaha, Nebr.; Wichita. Kans.; Denver, Colo.; Oklahoma City, Okla.; Dallas, Tex.; San Antonio, Tex.; Lubbock, Tex.; New Orleans, La.; Shreveport, La.

SHEFFIELD STEEL

Carbon and Alloy Steel, Ingots, Blooms, Billets, Plates, Sheets, Merchant Bars, Steel Joists, Structural Shapes, Road Guard, Reinforcing Bars

Welded Wire Mesh, Wire Products, Wire Rods, Fence, Spring Wire, Nails, Rivets, Grinding Media, Forgings, Track Spikes, Bolt and Nut Products

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Howard Supply Co. Names Managers Of Rubber Goods, Export Divisions

Announcement of the appointment of Lee J. Laird as manager of the Mechanical Rubber Goods division has been made by Howard Supply Company, distributor to the oil industry for B. F. Goodrich Company. Alterations and additions are being made to the company's main warehouse at 5125 Santa Fe Avenue, Los Angeles, for the new department.

Lee J. Laird

For the past 14 years Laird has been in various managerial capacities at Chiksan Company. He is president of the Los Angeles Chapter of Nomads and is a member of the Petroleum Production Pioneers.

F. J. (Ole) Olson has been appointed general manager of the new Export division of Howard Supply Company. Olson was formerly vice president of Cardwell Manufacturing Company in charge of California sales and later in charge of export sales in New York. He was in charge of export sales for International Derrick & Equipment Company until he joined Howard.

Export offices are at 5125 Santa Fe Avenue, Los Angeles; 230 Madison Street, Oakland, Calif.; and at 30 Rockefeller Plaza, New York City.

United Oil Well Service, S. A., Elects Director and President

John G. Staudt, vice-president and general manager of Dowell Incorporated, with headquarters in Tulsa, has been named to the board of directors of United Oil Well Service, S. A., an associate company of Dowell Incorporated, with headquarters in Caracas, Venezuela.

Herbert Hoover, Jr., was elected president of the company. Hoover replaces C. W. Fowler, Jr., who died last fall.

Southern Engine & Pump Company Adds Engineer to Sales Staff

John D. Nicholson has joined the staff of sales engineers of Southern Engine & Pump Company, Houston. Nicholson, who was graduated from the Missouri School of Mines and Metallurgy with a degree in mining engineering, was recently associated with Kennecott Copper Corporation and with Standard Oil of Indiana at the Sugar Creek refinery. Prior to World War 2, he was with Humble Oil & Refining Company at Baytown, Texas. He served as an officer in the Air Corps during the war.

John D. Nicholson

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Oil Tool Division Sales Engineer Is Appointed by Byron Jackson

R. D. Faxon has been named sales engineer of Byron Jackson Company, Oil Tool division, with headquarters at Alice, Texas.

R. D. Faxon

Faxon, a graduate of Princeton University, served in the Army Air Force as a captain from June, 1942, to September, 1945. Upon his discharge he was employed by Socony-Vacuum Oil Company as a petroleum engineer at Zulia, Venezuela. He joined Byron Jackson Company in 1948.

Oil Well Supply Makes Personnel Changes In Central Midwest Area

Three personnel changes have been made in Oil Well Supply Company's Central Midwest division. G. Lee Fabj, district material supervisor at Midland, Texas, has been transferred to the Production Planning and Procurement department at the company's Dallas headquarters. Fabj is succeeded by Willis Blackwell, who has been manager of the Odessa, Texas, store. J. O. Donaldson has been named manager of the Odessa store.

Fabj joined Oilwell in September, 1943, as a field auditor and became district material supervisor at Midland in September, 1946. Blackwell has been with the firm since 1926, serving in stores at Borger, Pampa and Electra, Texas, and at Duncan and Ada, Okla., and as district warehouse supervisor at Odessa. Donaldson joined the company as a field representative at Monahans, Texas, in October, 1945.

L. L. Bower Is Appointed Chief Engineer of Waukesha Motor Co.

Lloyd L. Bower has been appointed chief engineer of Waukesha Motor Company, to succeed James B. Fisher, retired. Bower has been in the company's Engineering department more than 20 years, and has served as Fisher's assistant for ten years.

L. L. Bower

He entered the automotive transport field as layout draftsman and transmission specialist for Garford Truck Company. In 1921, Bower became assistant to the chief engineer of the Transport Truck Company, and later returned to the Garford Company where he remained until his appointment as installation engineer for Waukesha in 1927.

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- ★ Korex Steel Bourdon Tubes
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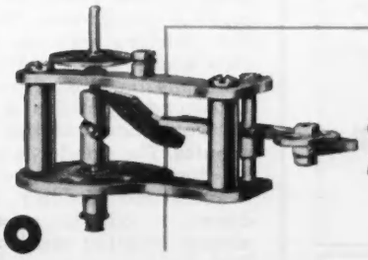

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HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

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■ WELL drilling spudders, beams, light rotaries, core drills, tools and casing. Used equipment at money saving prices. Spang and Mills new tools. Leschen lines. Everything for well drilling. Pressey & Son, Pueblo, Colo.

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ASTM A7-46

Immediate Delivery From Stock

310,000#	6"	WF-Beams	20#	40'
235,000#	8"	WF-Beams	31#	40'
215,000#	10"	WF-Beams	49#	40'
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125 Tons	12"	31.8# I-Beams		40'
85 Tons	15"	42.9# I-Beams		40'
90,000#	7"	9.8# Channels		40'
245,000#	8"	11.5# Channels		40'

550 Pc. 3" x 3" x 5/16" x 40' Angles
710 Pc. 3" x 3" x ⅜" x 40' Angles
440 Pc. 4" x 4" x 5/16" x 40' Angles
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70 Tons 2½" x 2½" x ¼" x 20' Angles

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Telephone: 4-8601

Black and Galvanized Steel Pipe

DELIVERY IMMEDIATELY FROM STOCK

20,000' to 80,000' Each size in stock

¾"	1½"
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1¼"	2½"

Prime Stock—T & C or Plain End
Full Mill Lengths—Domestic Pipe
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2 - M.C. 350 Bethlehem rotary drilling rigs complete with 127' Lee C. Moore Cantilever (Jack-knife) derricks, less drill pipe and drill collars.
For further information write:

SHARP DRILLING COMPANY
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FOR SALE

■ Failing 36 and Franks' Model 150 Pull Down in good condition. Working on contract. F. R. Findley, P. O. Box 6178, Houston 5, Texas.

For Sale
USED PUMPS

19 - Geared, Triplex, Outside Packed PLUNGER PUMPS.

Make—National Transit - Denning - Gould. Sizes—6 x 8, 5½ x 8, 5 x 6, 7 x 10.
For inspection, correspond with or call
South Penn Natural Gas Company,
Parkersburg, West Virginia.

For Sale
USED COMPRESSORS

20 Ingersoll-Rand Belt Driven, Type 10 COMPRESSOR UNITS:

Two stage 5½ x 10½ - 12" stroke
Two stage 10 x 18 - 12" stroke
Single stage size range from 6 x 8 to 17 x 12

For inspection, correspond with or call
South Penn Natural Gas Company,
Parkersburg, West Virginia.

It's New... Check It!

PIPE GRINDING MACHINE designed and built to give pipe line contractors maximum service in polishing the bevel on plain end pipe in preparation for welding. The machine can be placed on pipe easily and quickly, and will clean the bevel on 24-inch pipe in 15 seconds, whereas a man with file would have to work at least 15 minutes. The grinder is constructed for durability, light weight, effectiveness and economy. Electrically driven, it may be operated from electric welding machines on the line.

The Machine was perfected, and now being manufactured by

WICHITA TOOL REPAIR CO.
of Wichita Falls, Texas
Under license from O. R. Hall, inventor.

FOR SALE

For Sale
USED GAS ENGINES

37 - Stationary Gas Engines—2 cycle, with Belt Wheels

Make—Bessemer - Foose
Sizes range from 22 H.P. to 80 H.P.

For inspection, correspond with or call
South Penn Natural Gas Company,
Parkersburg, West Virginia.

HELP WANTED

■ WANTED—Geologist with at least six years' well completion experience in Texas Gulf Coast area. Address: Box 6, c/o World Oil, Houston, Texas.

ENGINEER: Midwest independent operating four refineries producing light oils, lubes, waxes and asphalts requires engineer with a minimum of 10 years refinery process and engineering design. Should be capable of carrying projects from economic study through process calculation, equipment design, and operating technique. Future for right man excellent. Give full particulars in first letter. Replies held confidential. Address: Box 4W, c/o World Oil, Houston, Texas.

PETROLEUM SALES EXECUTIVE: Large midwest independent has immediate opening for experienced bright stocks and neutrals sales executive. Unusual opportunity. In replying give full information stating age, education, experience, salary required. Replies will be held confidential. Address: Box 3W, c/o World Oil, Houston, Texas.

SALES MANAGER
Oilfield Equipment

Old established manufacturer desires Sales Manager to direct and increase sales of Well Head and Christmas Tree products. Applicant must have had previous experience in above fields.

Address: Box 12W, c/o World Oil, Houston, Texas.

OVERSEAS AND DOMESTIC EMPLOYMENT

All types Professional, Exploration, Technical and Office Personnel, Skilled Oil Field Workmen and Tradesmen. OVERSEAS Personnel Employment Service, 520 Southern Standard Bldg., Houston 2, Texas.

WANTED TO BUY

EQUIPMENT WANTED

■ Am interested in purchasing good second-hand, unit 15 rig, with either 2 or 3 motor compound. Please send description, price, and location to World Oil, Box 2608, Houston 1, Texas.

New Books and Maps

Gas Hydrates

Monograph 8, by W. M. Deaton and E. M. Frost, Jr., of the U. S. Bureau of Mines, on "Gas Hydrates and Their Relation to the Operation of Natural Gas Pipe Lines," has been released by the bureau as a cooperative project with the Natural Gas Department of the American Gas Association.

The work of preparing Monograph 8 was begun in 1935 and except for three war years was continued to the present. The Monograph is a compilation of the work done during a period of 15 years.

In 1934, a paper by E. G. Hammerschmidt revealed that many "freezes" in natural gas pipe lines, which seriously effected the capacity of the lines, were caused by hydrates and not water ice and that "freezes" in natural gas lines were not confined to areas of extremely low temperatures. It was this revelation which exicted the interest of natural gas men and this cooperative study was begun.

The monograph presents information on pipe line problems resulting from the formation of hydrates, the kinds of "freezes" in the line, the temperatures at which they occur, the experiences of pipe line operators, and the methods used to free the lines.

Monograph 8 is on sale through the Natural Gas Department, American Gas Association, 420 Lexington Avenue, New York 17, N. Y., priced at $1 per copy for members and $1.50 per copy for non-members, without quantity discount.

Oil Reserves in Colorado

A comprehensive study of the oil shale beds cropping out in Naval Oil Shale Reserves 1 and 3, Garfield County, Colo., reveals a vast potential reserve of oil larger than hitherto believed present. The study, made by the U. S. Geological Survey in cooperation with the Department of the Navy, Office of Petroleum and Oil Shale Reserves, shows the geology of an area northwest of Rifle, Colo., covering approximately 175 square miles. The map and accompanying data are printed on two sheets, which measure 40 by 52 inches each.

Director, U. S. Geological Survey, Washington 25, D. C., $1.

SITUATIONS WANTED

■ Experienced Lease and land man desires connection with Oil or Gas Company who plan to operate in the San Joaquin or Sacramento Valleys, California. Thoroughly familiar with these areas. Presently self employed. Salary $500 a month and expenses. Reply P. O. Box 1024, Marysville, California.

■ Position wanted with large independent producer, who is doing own drilling, or with progressive drilling contractor as drilling Engineer or Superintendent. Have fifteen years experience in various phases of drilling and engineering including directional drilling, mud engineer, formation testing, electrical and mud logging. Couple hundred hours as private pilot. Capable of handling and planning drilling costs. Thirty-nine years old, married, sober. Will furnish excellent references. Minimum starting salary considered $7200.00 annually. Address: Box 9W, c/o World Oil, Houston, Texas.

■ Experienced operator can handle part time lease and royalty buying accounts in Gulf Coast States. Box 15W, c/o World Oil, Houston, Texas.

NOTICES

■ LEASE AND ROYALTY BUYERS always available for order buying in Louisiana and nearby states; write Original Leasing Service, Box 1606, Alexandria, Louisiana.

■ KANSAS OPERATOR, MAJOR COMPANY EXPERIENCE LAND DEPARTMENT, WILL ACT AS AGENT CAPITAL SEEKING OIL INVESTMENT. Address: Box 10W, c/o World Oil, Houston, Texas.

■ OIL PROPOSITION. Interested in leases for drilling with approximately 3000' pay or less. Gulf Coast Area. Address: Box 11W, c/o World Oil, Houston, Texas.

OIL AND GAS OPERATORS

■ Gas from 16 producing areas in Sacramento Valley, California, has a 1949 contract price at the well of 19c per mcf. Producing depth ranges 3,000 to 4,000 feet. Drilling blocks available in favorable areas. Address: Box 14W, c/o World Oil, Houston, Texas.

LEASES, DRILLING, ACREAGE, ETC.

■ SEE A. L. BOWLES, ADA, OKLAHOMA, FOR SHALLOW DRILLING DEALS IN OKLAHOMA.

■ We will buy producing or non-producing oil royalties. Send particulars. Standard Security Co., 115 Broadway, New York 6.

ROYALTIES IN HOT AREAS!

■ Recent strikes have focused attention on Montana's deeper oil zones and major companies are moving in fast, drilling and leasing. We buy direct in the field, sell direct to our customers. Write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

■ Prospective new shallow, high gravity oil field, N. W. Ga. Mississippian-Devonian shale and limestone exposures. Good structural indications. Drilling deals considered. Dietzen, Rt. 3, St Elmo, Tenn.

To operators: We will sell or deal, up to 1,000 acres proven for 40 gravity oil by structural position and electric log, at 2400 feet depth. Wells 30 to 100 barrels per day. Cost $11,000 to "see the sand". Market by either of two interstate pipeline carriers. All usually needed casing furnished at cost or on oil payment if desired. We will operate for you, if desired. Address: Box 16W, c/o World Oil, Houston, Texas.

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NEW LIGHT PLANTS
Kohler Model 1M21-A

36 New 1½ KW, 110 Volt, 13.6 Amps, 60 Cycle, Single Phase, 2 Wire, 100% PF, Kohler Generators, 1200 RPM, direct connection to Kohler Liquid Cooled Gasoline Engine, Manual Start (Crank)—Complete with Fuel Tank, Air Cleaner, Oil Filter, Muffler, Exhaust Pipe, and approximately $75.00 worth spare parts and tools. Net Weight 497 lbs. Boxed Shipping Weight 880 lbs.

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Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.

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ENGINEER WANTED

Graduate engineer experienced in the design of drilling rigs is offered a permanent position with old, reliable and progressive independent company located in the Southwest. Give background and experience. All answers confidential.

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FREE TURNING CONES . . .
. . . FOR WATCH FOBS OR CHARMS

Precision made of brass. Beautifully finished. Gold plated $5; nickel plated $4. Money order or C.O.D. orders filled promptly. Specify ring type or with strap as illustrated.

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EXPERIENCED PRACTICAL
AND TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE

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SPECIALIZING
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SECONDARY
RECOVERY

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Stands the gaff and gets the job done without scoring brake rims. See pages 3973-3978, Composite Catalog.
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COASTAL OIL FINDING COMPANY
Established 1928
ESPERSON BLDG. HOUSTON, TEXAS

HOUSTON LABORATORIES
Analytical and Consulting Chemists
Podbielniak Gas Analyses, Oil Field Brines, Waters, Cores, Muds, etc. Reservoir equilibria studies for crude and condensate wells.
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SQUEAKS from the BULLWHEEL

Natural Talent

"Mrs. Jones had triplets and two weeks later she had twins."

"That's impossible. How did it happen?"

"Well, one of the triplets got lost."

How's Life With Fodder?

Rain was pouring down at the race track. "Don't bet on Galloping Gal," advised one patron. "She ain't a good mudder."

"Yeah?" piped up his friend. "Wot's her family affairs got to do wid it?"

Incognito

The Hillbilly, with a dizzy blonde hanging on his arm, took the pen handed him by the hotel clerk and signed the register with an X. With a thoughtful look on his face, he hesitated, then circled the X. "A lot of people sign with an X," said the clerk, "but that's the first time I've ever seen it circled."

"'Tain't nothin' so dadburn odd about hit," retorted the hayseed. "When I'm a-runnin' around with wild wimmen, I don't use my right name."

A Matter of Time

"What's the difference between a little girl and a big girl?"

"A little girl wants an all-day sucker. A big girl just wants one for the evening."

Through the Years

The art of wolfing hasn't changed much through the centuries. The Greek maidens used to sit and listen to a lyre all evening, too.

Birds and Bees Stuff

"Where did I come from, mama?" asked the little girl.

"The stork brought you."

"And did the stork bring you, too, mama?"

"Yes, he certainly did."

"And did he bring grandmother, too?"

"Yes, he brought grandmother, too."

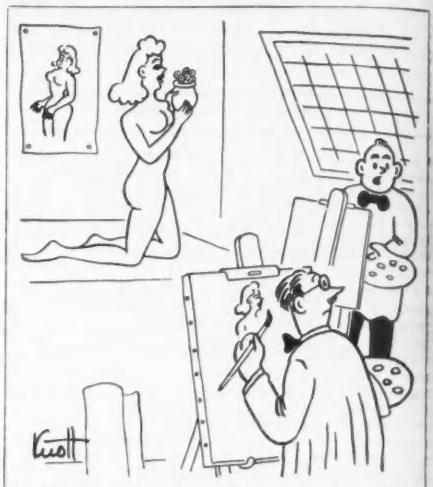
So the little girl wrote on her composition paper: "There hasn't been a natural birth in our family for three generations."

Sense of Direction

The proofreader on a certain small southern newspaper happened to be a woman of great precision and extreme propriety. One day a reporter succeeded in getting into type an item about "Willie Brown, the boy who was burned in the West End by a live wire."

On the following day he found on his desk a frigid note from the proofreader asking, "Which is the West End of a boy?"

It took him only an instant to reply: "The end the son sets on, of course."



"There's a pretty daring strip-tease at Minsky's this week."

Poor Companion

"Do you smoke?"
"No."
"Drink?"
"Nope."
"Neck?"
"Of course not."
"Eat hay, maybe?"
"Well, certainly not."
"Woman, you're not fit company for man or beast."

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All NEW & COMPLETELY REVISED. Covers entire U. S., CANADA, and FOREIGN AREAS. Personnel list of more than 2000 names, 700 GEOPHYSICAL CONTRACTORS and SUPPLIERS. 60 FOREIGN and 270 DOMESTIC OIL COMPANIES using geophysics.
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...s The OIL WEEKLY

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WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING, PRODUCING, PIPE LINE OPERATIONS AND MANAGEMENT

...scription Price, $5 Per Year APRIL, 1949 Price This Copy, 50 Cents

HUGHES *SEAL GRIP* TOOL JOINTS

THE BEST THREADED PIPE CONNECTION AVAILABLE

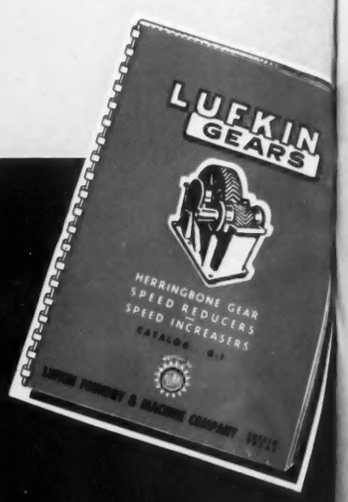
HUGHES TOOL COMPANY
HOUSTON, TEXAS
...LD STANDARD OF THE INDUSTRY

Hughes Seal Grip Tool Joints may be installed, removed, and replaced anywhere . . . designed for maximum strength, safety, with complete utility as to field replacement. Hughes Seal Grip Pipe Threads have a dependable seal at both ends, either of which, alone, is capable of preventing dangerous "wash-outs." Engaged surfaces are maintained in new condition so that joint strength is not affected by corrosive attack. This feature is particularly advantageous when joints are used on succeeding strings of pipe. The three elements of the Hughes Seal Grip Connection . . . outer seal, engaged threads, and inner seal . . . are on the same steep taper and therefore on a single cone, providing uniformity of fit on initial and replacement installations and a friction grip stronger than the torsional strength of the pipe, when properly installed. This is another example of a Hughes "Engineered Solution."

THERE'S NOTHING AS FINE as the LUFKIN LINE

LUFKIN 35-9 with gas en
drive and sub-base. Tide W
Associated Oil Company, Ye
Creek, Mississippi.

LUFKIN pioneered and developed the application of reduction gears to oil well pumping. The first unit was placed in operation in a gulf coast field in 1923. In the more than a quarter century of specialization in the manufacture of walking beam type pumping units, Lufkin has attained the enviable position of number one producer of such equipment.
Applied skill, plus constant improvement in design and application of Lufkin units, has contributed to the maintenance of that position.
It shall be always the Lufkin objective to produce the very best unit in the field.
Yes sir! There is nothing as fine as the Lufkin Line!



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ranch sales and service Houston, Dallas, New York, Tulsa, Los Angeles, Seminole, Oklahoma City, Corpus Christi, Odessa, Kilgore, Wichita Falls, Casper, Wyoming; Great Bend, Kansas.

More than 60,000 commercial gear reducers and speed increasers—in full-line range of sizes, have been produced in our Lufkin plant under the supervision of men with more than a quarter of a century experience. Write for our latest catalog!

LUFKIN PUMPING UNITS

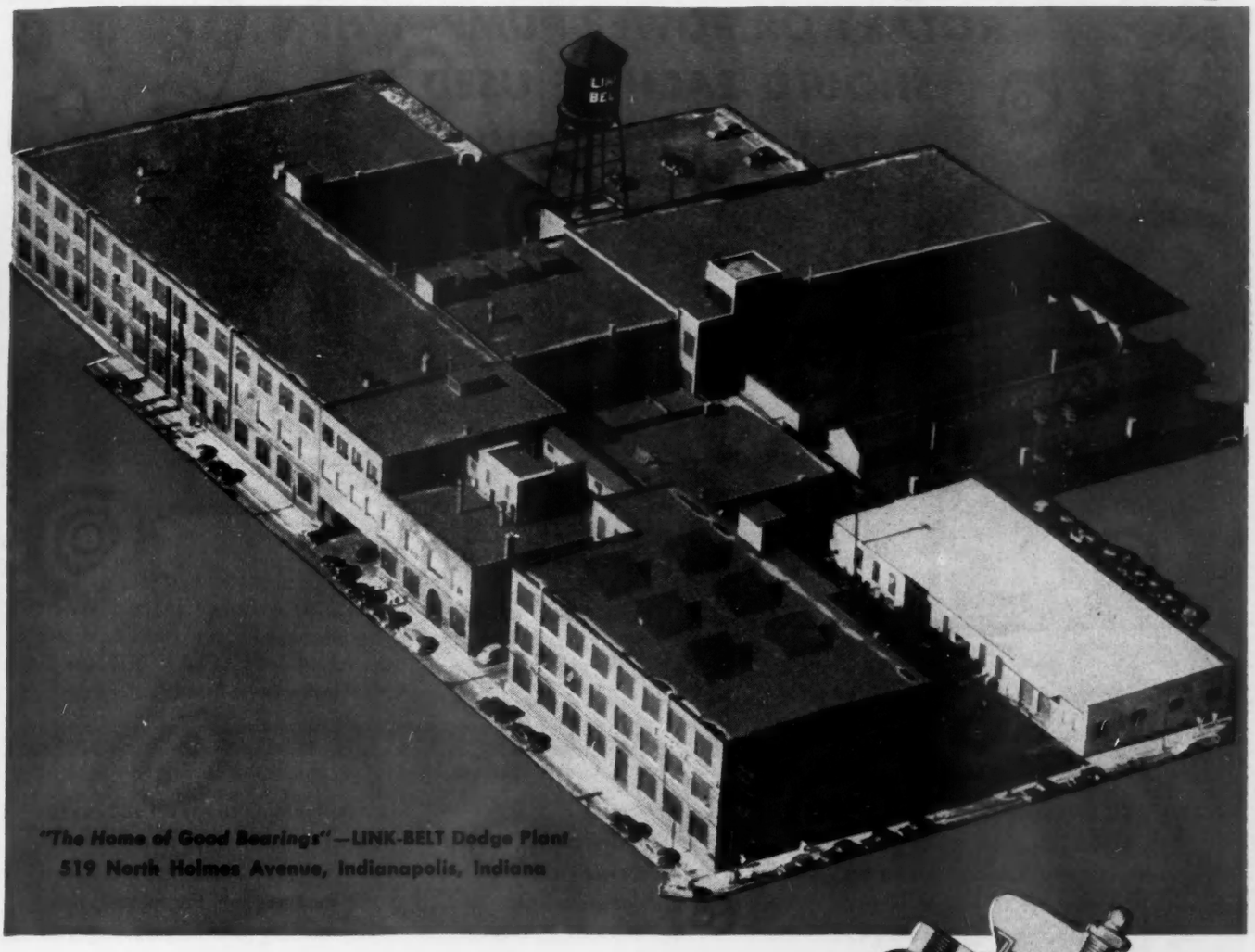
LUFKIN-COOPER-BESSEMER ENGINES

LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS

INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY
INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

One LINK-BELT Plant devoted *Solely* to bringing you better bearings—*Quickly*



"The Home of Good Bearings"—LINK-BELT Dodge Plant
519 North Holmes Avenue, Indianapolis, Indiana

Meeting industry's ever-increasing demands for ball and roller bearings that offer the desired combination of free-rolling action, self-alignment, and long life is no small-sized job.

That's why the entire capacity of Link-Belt's Dodge Plant in Indianapolis is devoted to this important task.

From the receipt of housing castings furnished by sister plant foundries to shipment of finished mounted bearings, alert design engineers, skilled craftsmen and the most modern bearing production machinery work hand-in-hand to turn out the bearings that enable users to TURN SHAFTS EFFICIENTLY.

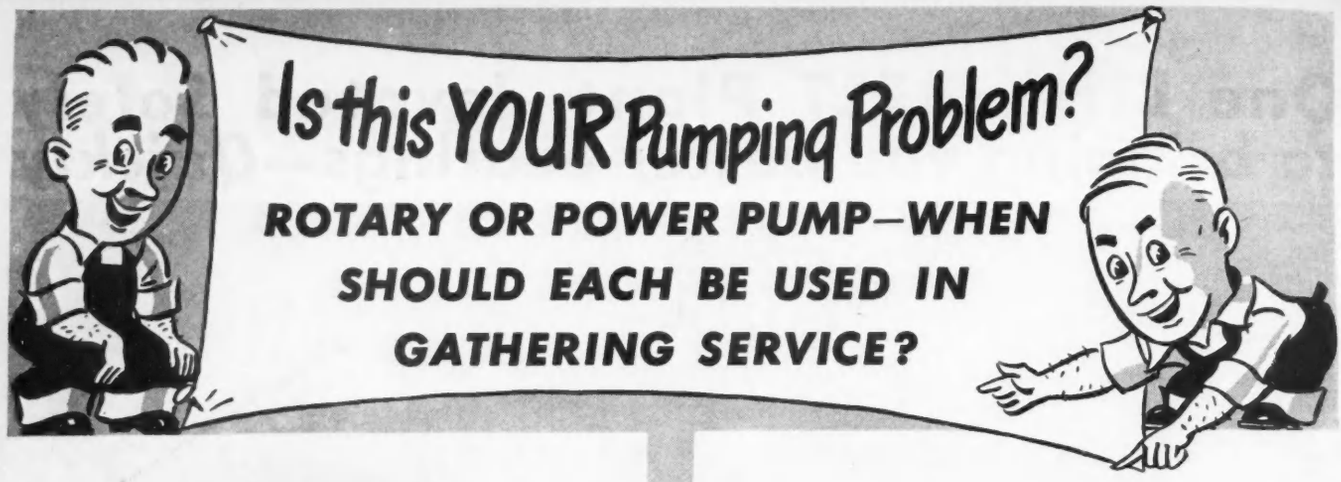
Cut-away view of Series 200 Ball Bearing Pillow Block

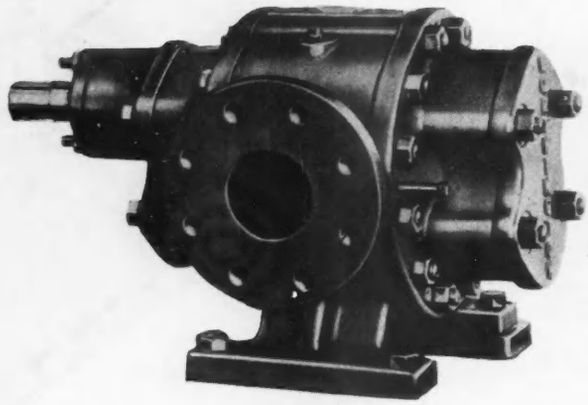
LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia [illegible] Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Distributors in Principal Cities

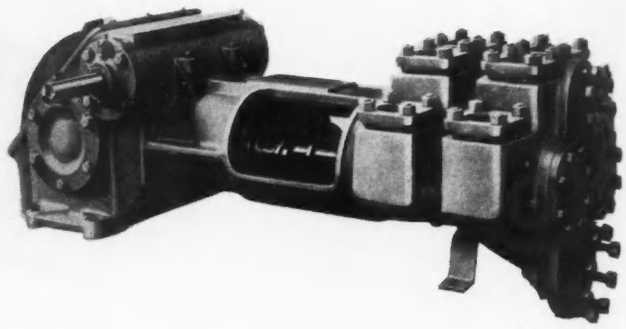
11,387

LINK-BELT — *Ball and Roller BEARINGS*





A Worthington Rotary Pump



A Worthington Power Pump

WHETHER to use a rotary or a power pump on gathering lines depends largely on capacity losses which, in turn, are affected by operating pressures. Capacity losses are minimized by: (1) close clearances between casing and pumping elements; and (2) by packing against wear to maintain these clearances.

Rotary pumps depend on close clearances alone, since packing against wear is usually impossible. Therefore, they are best for pressures of 500 psi or less, where capacity losses are negligible. Other rotary advantages for low pressure gathering duty are: light weight, portability, excellent suction qualities, self-priming ability under difficult conditions, and low original and replacement costs.

Power pumps, being packed against wear to maintain close clearances, are fortified for high pressure loads. And, since they are stationary, comparatively heavy, with easily replaceable parts, they give best results in high pressure gathering.

Pumps for Every Need

Worthington's long experience in custom-building to the oil and gas industries' special requirements assures you exactly the right type and size of pump for every job. For fact-full literature proving *there's more worth in Worthington*, drop a line, stating your pumping problems, to *Worthington Pump and Machinery Corporation, Pump and Compressor Merchandising Division, Harrison, New Jersey.*

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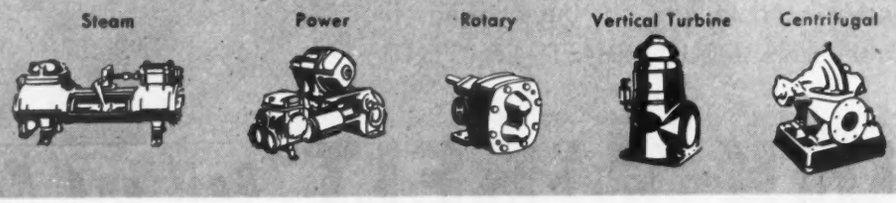
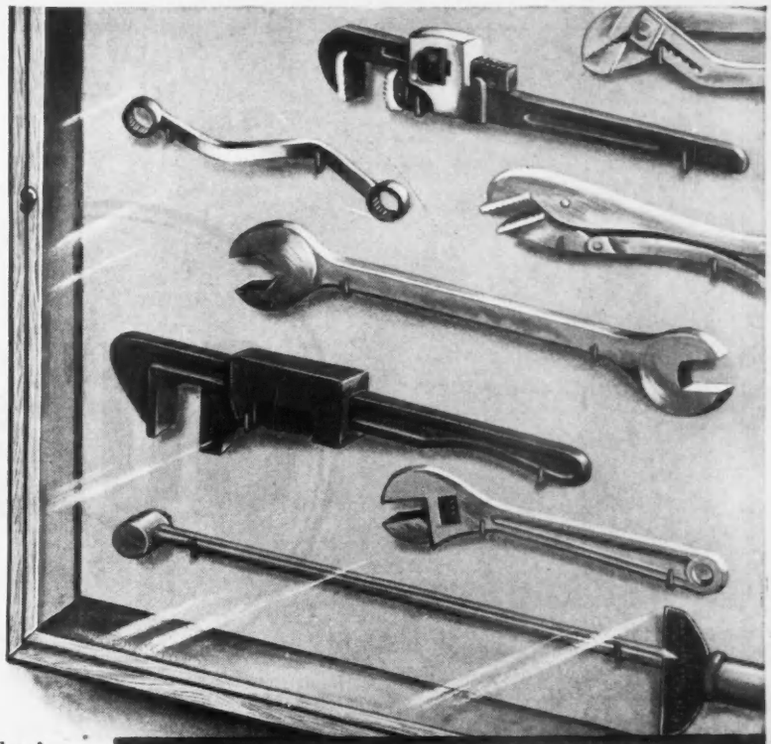


WORLD OIL, published every month except semi-monthly in February. Entered as *The Oil Weekly* as second class mail matter December 23, 1916, at the post office at Houston, Texas, under the act of March 3, 1879.

You pick the Wrench that's right-

buy your V-belts the same way



FOR any job you do, there's just one wrench that's *right*. And for V-drives, there's only one right type of V-belt. That's why Goodyear offers the most complete line of V-belts — *featuring a construction to meet every drive requirement.*

For drives where belt stretch and maintenance are problems, there's the exclusive Goodyear development — COMPASS-V-Steel belts with wiry, steel-cable load carriers. If the drive runs at high speed, over small pulleys on short centers, choose a Goodyear belt bodied with single-plane endless cords for high flex-life. If you're having trouble with high overloads and shock stresses, pick a Goodyear belt built around multiple, high-tensile resilient cords. For drives where belts are hard to apply — or for quick emergency replacements — use Goodyear's open-end belting with a special fabric body of high fastener-holding strength.

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When desired, these time-proved constructions can be supplied—built with oil-resistant, heat-resistant or non-static rubber. The G.T.M. — Goodyear Technical Man — will gladly recommend the proper Goodyear V-belt to give you long, trouble-free service at the lowest ultimate cost. Write: Goodyear, Akron 16, Ohio.

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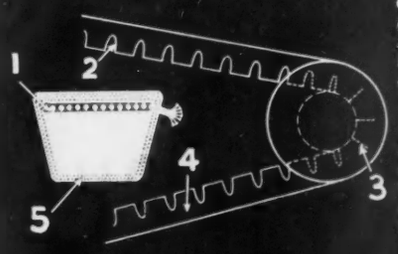

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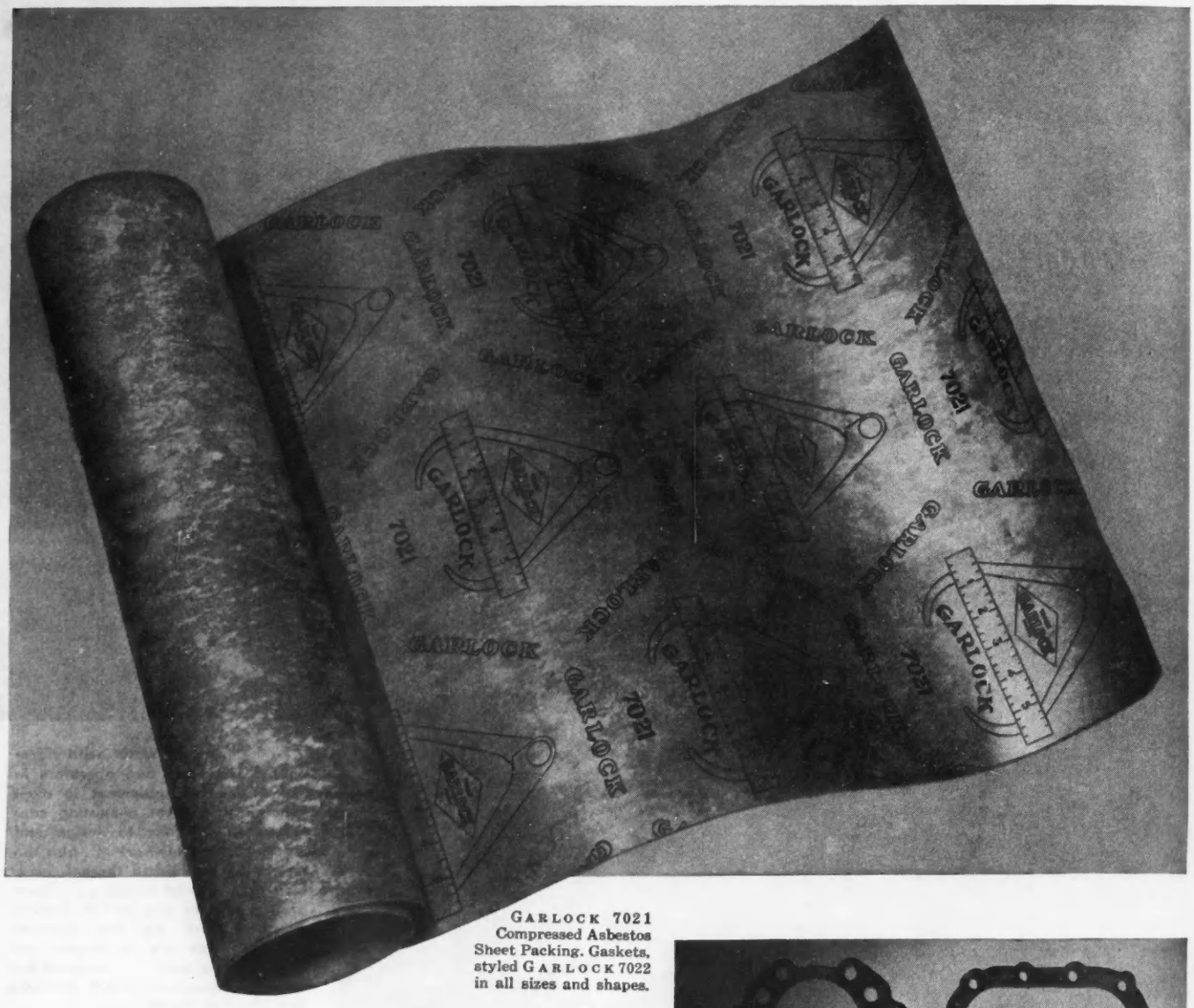

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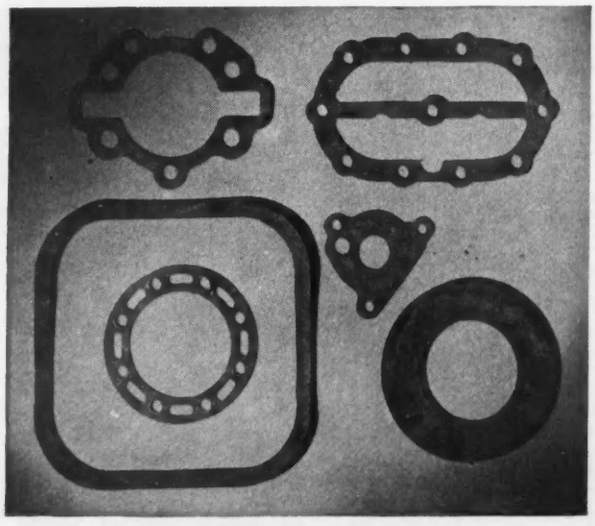

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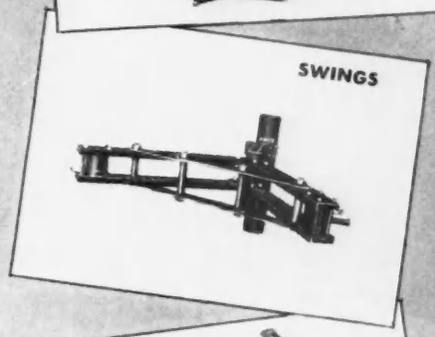

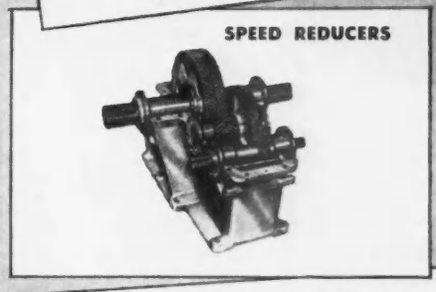

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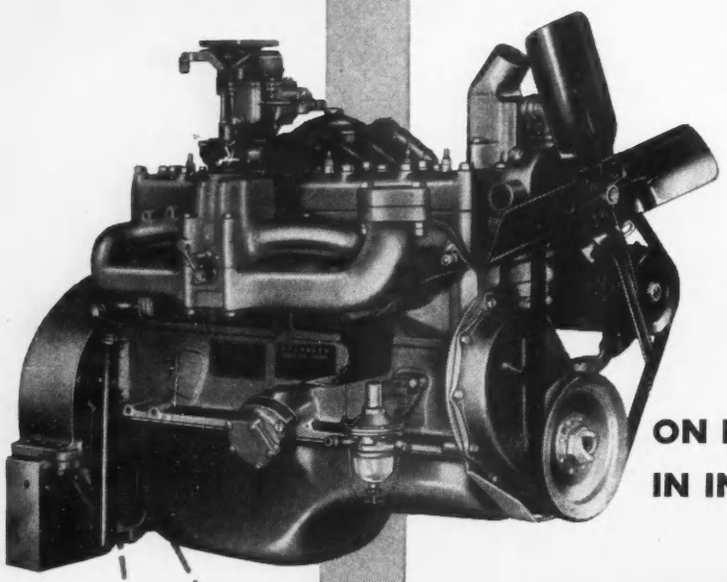

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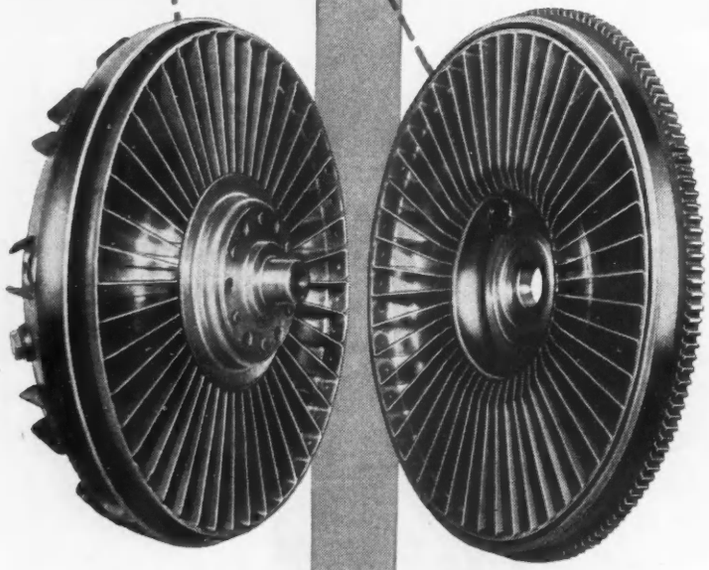

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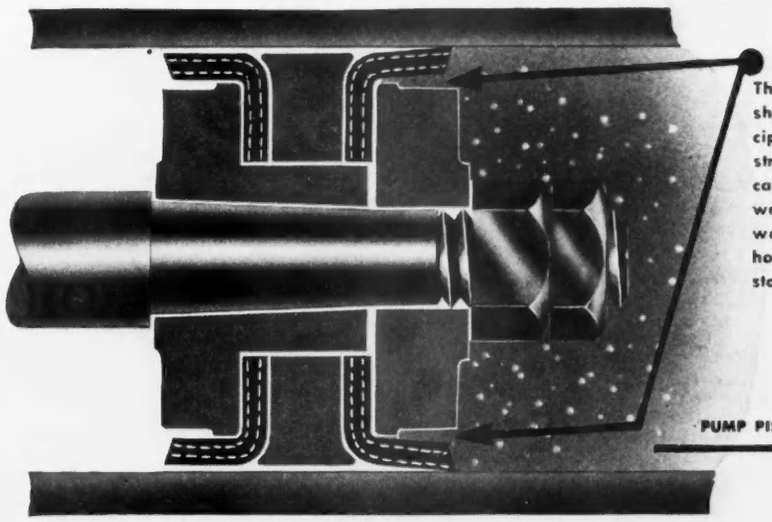

This greatly exaggerated diagram shows the Darcova Pumcup principle. On pressure side of each piston stroke, flexible Pumcup is automatically forced against liner or cylinder wall. Firm, uniform contact all the way around eliminates slippage, holds volumetric efficiency at constant high in spite of gradual wear.

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THEY NEVER RELAX
when the pressure is on!

HERE is a piston packing that actually takes *advantage* of the fluid pressure built up in reciprocating pumps and in air or hydraulic mechanisms. The illustration above shows how Darcova Pumcups utilize this pressure . . . how they hug the cylinder wall on every work-stroke of the piston, preventing needless slippage.

Then, too, friction between the Pumcup and cylinder is automatically "pressure-equalized" all the way around for a uniformity of wear otherwise impossible. And, in contrast to other types of packing, fluid slippage does not increase with wear. Peak volumetric efficiency is retained even when Pumcup wear is far advanced.

Consequently, Pumcups offer two mighty important advantages. First, downtime and material and maintenance costs are cut to a fraction because Pumcups outlast other types of packing many times over. Secondly, volumetric efficiency is held constant.

Everything considered, it is easy to see how thousands of Darcova Pumcup users are saving up to $100 per pump per year. Easily installed, Pumcups replace ordinary packing in reciprocating pumps and in air or hydraulic mechanisms. They are precision built in ½ to 42 inch sizes and in many different textures for practically all fluids, pressures and temperatures.

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It had been the only nearby passage to Tulsa and eastern Oklahoma. Passenger and road freight traffic was paralyzed. Communities, businesses, were cut off from vital supplies.

At Continental Oil Company's plant at Ponca City, welders worked night and day, cutting 24-inch oil pipe into ten-foot lengths, capping the ends with steel plates they welded into place. Then with these rough pontoons and other materials loaded onto trucks, a caravan rolled swiftly to the river's edge.

Toiling like beavers, the men soon threw a line of the oil-pipe pontoons across the raging stream. On top of these, they placed parallel lengths of channel-iron, properly spaced to make a floating roadway from bank to bank.

Trucks began to roll again with their needed cargoes. Cars and busses bore their relieved passengers across the torrent. And that pontoon bridge of oil pipe served a quarter of the state for months, until the highway bridge was replaced.

This kind of unhesitating help that Continental rendered is, we believe, typical of the oil industry. There are hundreds of such examples that demonstrate how deeply and basically a part of the community the oil business is.

Continental is proud to uphold this traditional "good neighbor" policy of the industry. We believe it has played a large part in the stability and reputation that Continental has so long enjoyed . . . as well as helping make possible our constant expansion—past, present and future.

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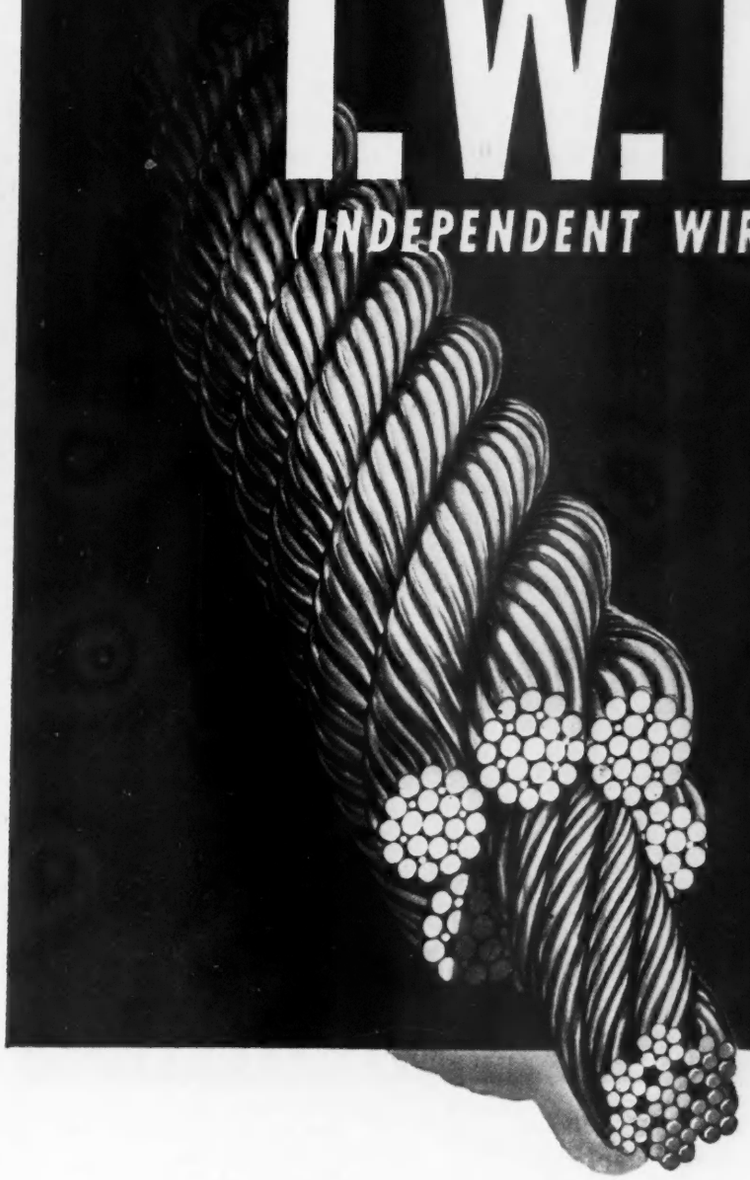
(INDEPENDENT WIRE ROPE CORE)



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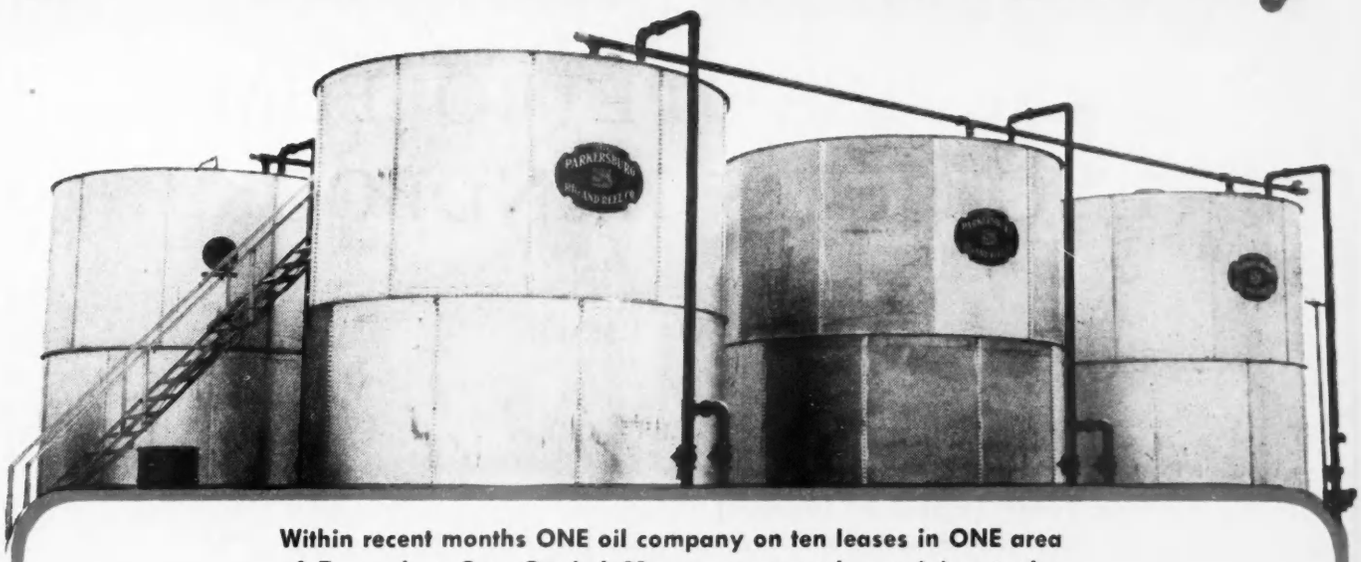

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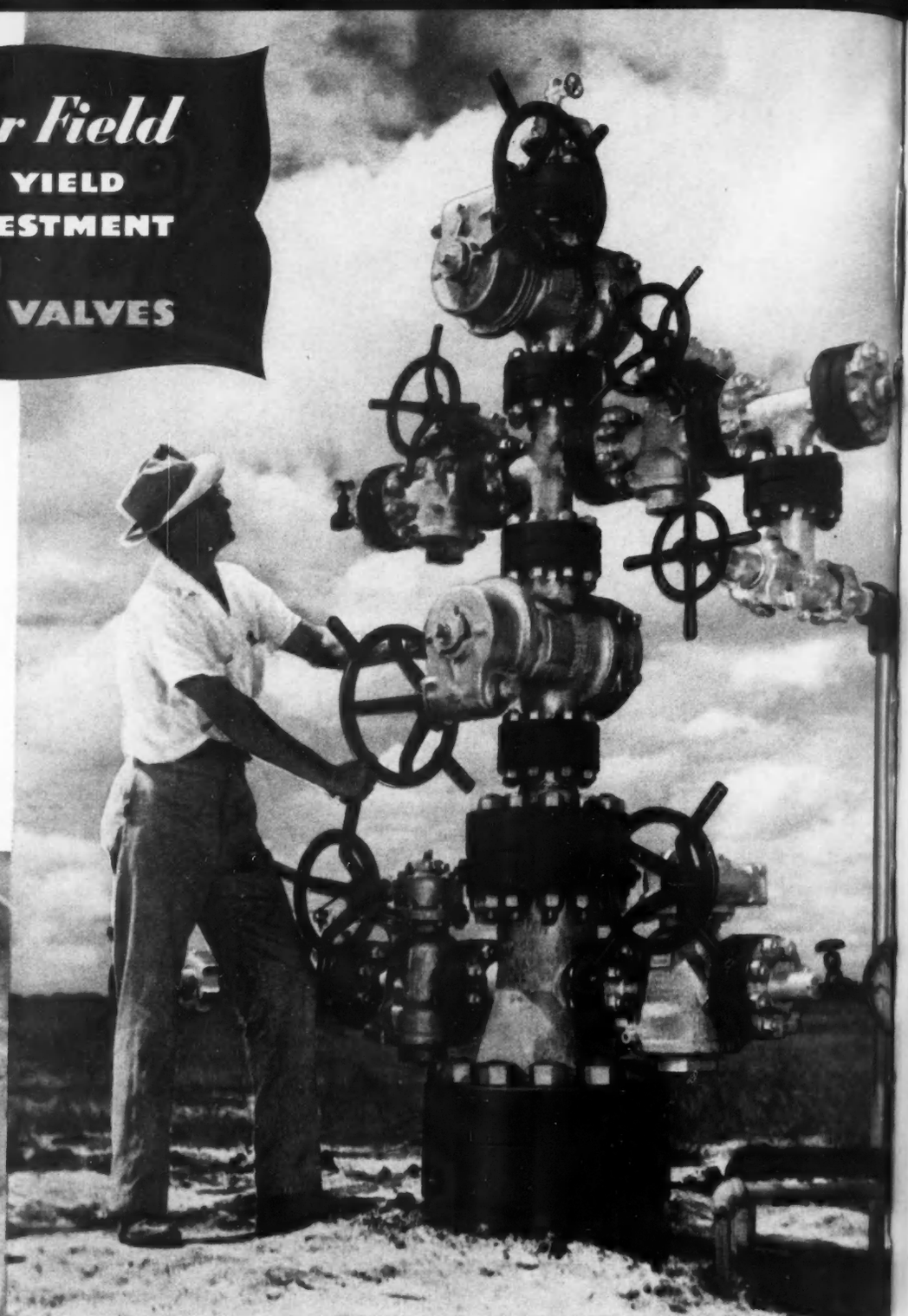
("SEALDPORT" LUBRICATION ADDS FURTHER PROTECTION)
The arteries of a processing plant are its flow lines. Top capacity production requires perfect functioning of *every* line. Nordstrom valves insure uninterrupted operation; quick, positive shut-off and freedom from hazardous leaks because their inherently sound engineering design has eliminated every valve weakness. Internal lubrication, serving the *triple* function of facilitating plug rotation, sealing the ports and jacking the tapered plug, is a vital asset that alone makes Nordstroms the most advanced valves of industry.
Use only genuine Nordcoseal lubricants
Nordstrom LUBRICATED VALVES

In Plant or Field

A GREATER YIELD ON VALVE INVESTMENT WITH NORDSTROM VALVES

Valves are a major investment. Their true cost must be based on performance and lifetime endurance. Cost-minded engineers are specifying Nordstroms because these valves yield more service per dollar invested; there is an appreciable saving in man-hours; and greatest convenience in operation.



Nordstrom simplicity provides a valve with few parts. All standard specifications are met. A complete range of sizes, pressures and types permits selection of practically custom-made valves for each specific application. Nordstrom engineering service at plant and in the field is of highest caliber, offering experienced counsel in valve selection.

KEEP UPKEEP DOWN

Use only genuine Nordcoseal lubricants

Nordstrom

VALVE DIVISION

Rockwell Manufacturing Co.

400 N. Lexington Ave., Pittsburgh 8, Pa.

Sales Offices in principal cities. *Export:* Rockwell International Corporation, 7701 Empire State Bldg., New York 1, N. Y.

EASY DOES IT... *FAST!*

Quick stabbing and fast spinning are but two of the *many* advantages resulting from the consistent uniformity of Republic Electric Weld Casing and Tubing.

Equally important are the pull-out protection and resistance to collapse which you get in every length—assured by uniform wall thickness, uniform roundness, uniform strength and soundness—each resulting from Republic's *improved* process of electric resistance welding. Each length is formed from high ductility steel... fully normalized for uniform structure. Casing is cold sized for high yield strength.

Yes, easy does it . . . fast—*and safely, too,* when you use Republic Electric Weld Casing and Tubing.

Republic Electric Weld Casing and Tubing are made from flat-rolled steel, both sides of which are inspected. Thus, the surface which becomes the inside wall is free from hidden defects.

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GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department:
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NORMALIZED CASING AND TUBING

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● When you see STURDYBILT Prefabricated Demountable Houses being erected on oil field sites in days instead of weeks, you'll think there's magic at work. The fact is, building field housing projects by using STURDYBILT Houses, is the modern, common sense way to get employees and equipment under cover in a hurry. Whatever your field housing need . . . investigate STURDYBILT Prefabricated, Demountable Houses . . . *first.*

. . . . but it's just common sense!

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SOUTHERN MILL & MANUFACTURING CO.

• TULSA, OKLAHOMA •

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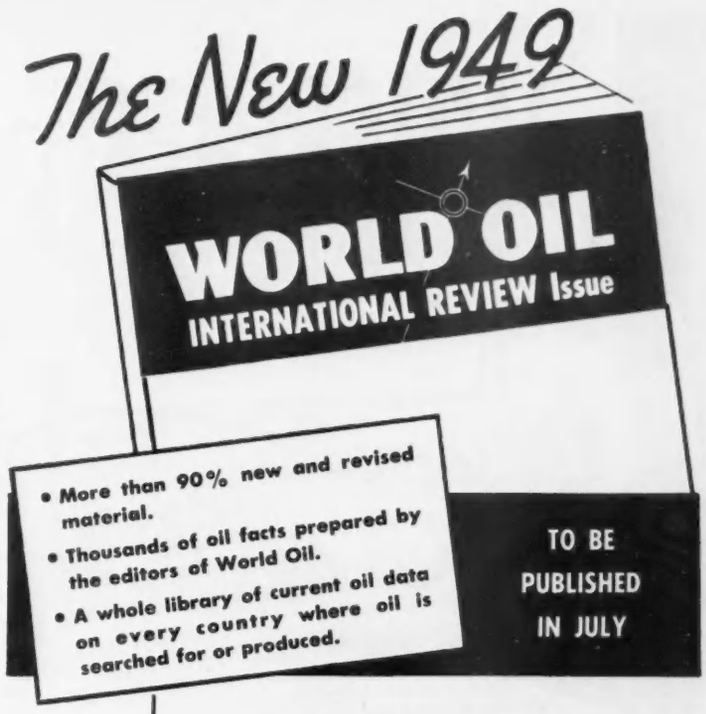
This popular oil fact-book will give the most complete, up-to-the-minute oil maps and data on world-wide drilling, production, refining and pipe line activity published anywhere at any time.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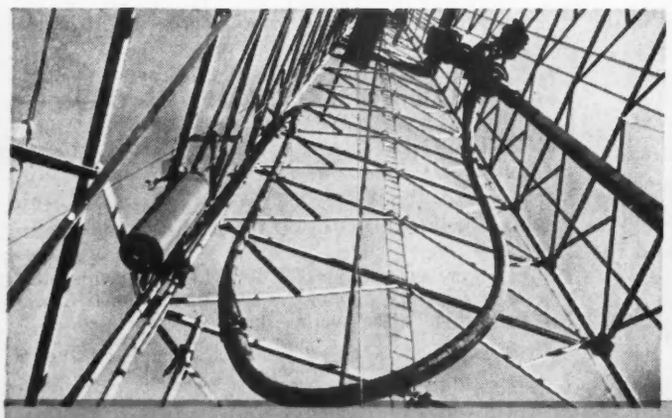

At the derrick

Hewitt Rotary Drilling Hose cuts your operating costs. That's because it brings you the strength of steel and the flexibility of rubber. It is specially built for today's higher drilling pressures. It is tough enough to resist scouring drilling muds . . . yet it's flexible enough to stand constant bending.

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Hewitt Tank Car Hose speeds your bulk movement of petroleum products. Its all-synthetic, oil-resistant tube and cover make it ideal to use where the inside and outside of your hose are in contact with gasoline or oil. Its smooth-bore tube assures you fast flow under pressure or suction.

need dependable hose . . .

they rely on Hewitt Hose engineered to meet their specialized needs

Whatever the job may be, you can always depend on Hewitt Hose to give you the utmost in performance.

You see, the complete line of special-purpose Hewitt Hose is *engineered and manufactured to meet your exact needs.*

Your investment in Hewitt Hose is safeguarded by the constant practice of:

Continuous research. It is no mere chance that Hewitt has brought you so many "firsts" in hose design and construction. It is the result of long and constant research by expert Hewitt technical men.

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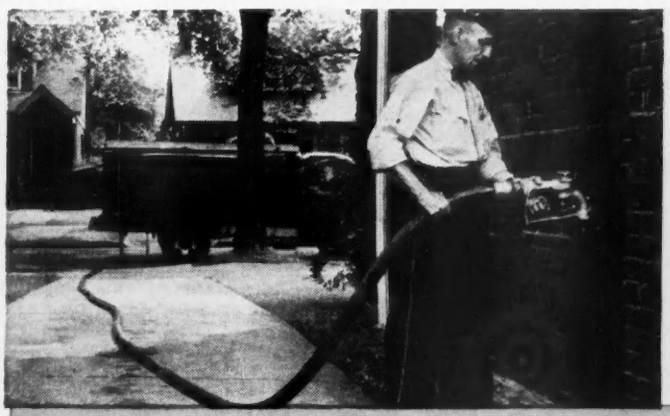
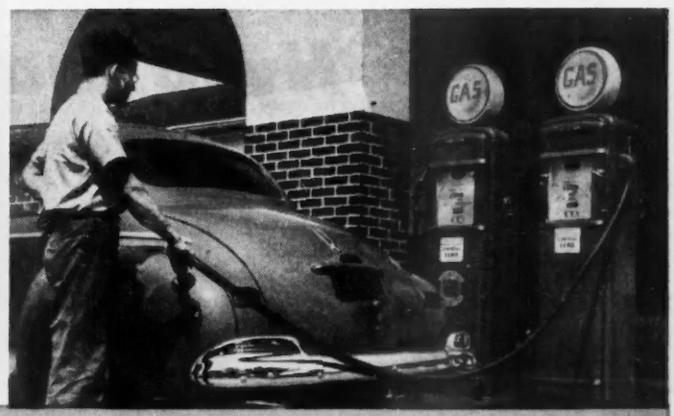
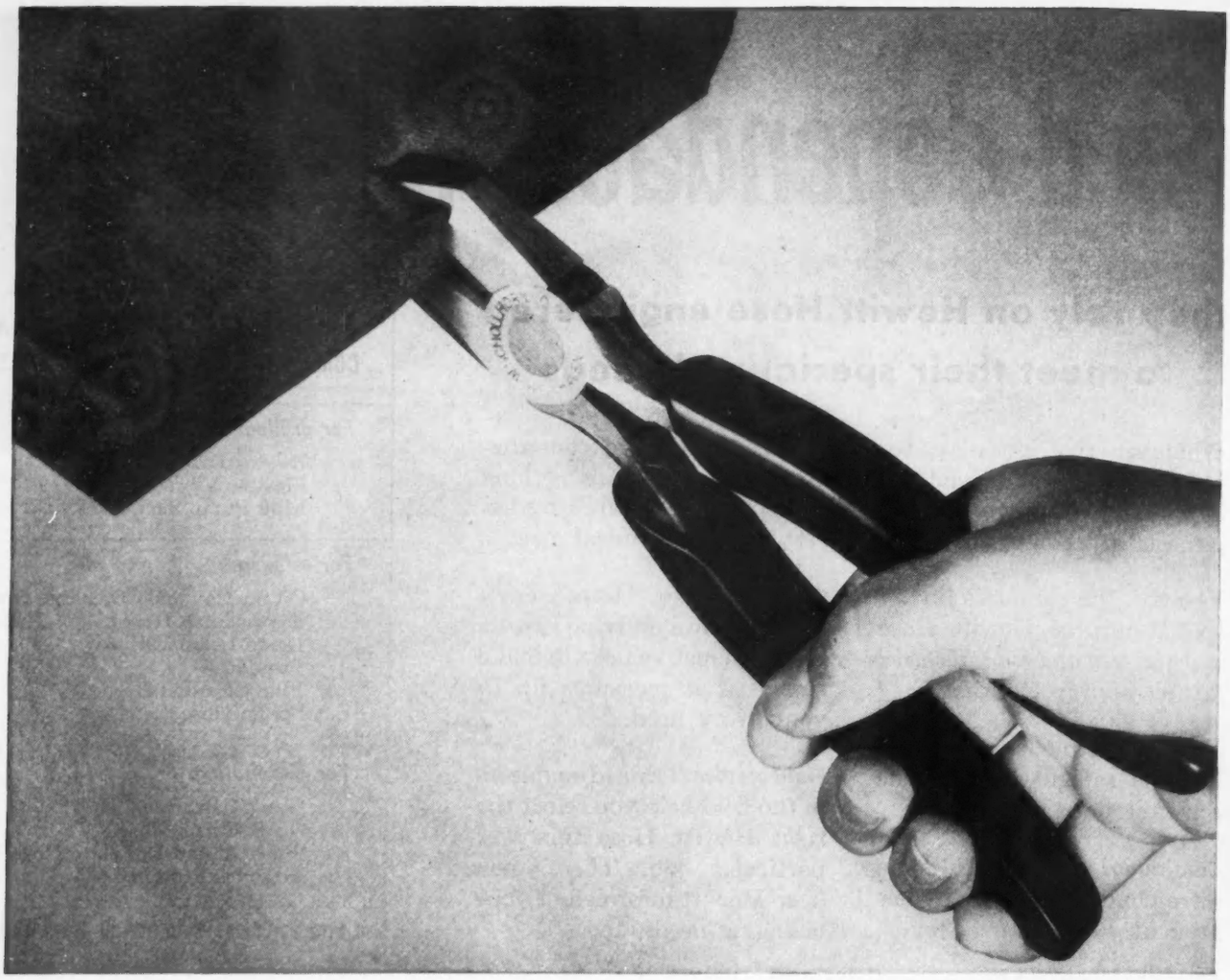
HEWITT-ROBINS HR **INCORPORATED**





At the truck **Hewitt Fuel Oil and Distillate Hose saves you time and trouble** in delivering fuel oil or gasoline under pressure. Its carcass is especially compounded for that type of service. And its cover resists abrasion, weathering, and the rotting action of oil and gasoline. This hose is light and flexible for easy handling, too.

At the pump **Hewitt Gasoline Pump Hose resists the destructive effects of gasoline . . .** will not discolor your fuel. Has a smooth bore for speedy flow of fuel. Stays flexible even in coldest weather. Multiple plies of extra strong braided cord . . . bonded with synthetic rubber . . . resist crushing, pulling or expansion.



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MANHATTAN'S NEW RAY-MAN ROTARY HOSE

Making Hole in Hog Canyon

In the Ventura Avenue Field, Ventura, California, RAY-MAN Rotary Hose is showing unusual drilling performance. At the time this picture was taken making hole in Hog Canyon, they were down 12,775 feet. The hose has been in continuous use since June 12, 1947.

Pressure has been 2,000 to 2,500 pounds, but the driller reports "No difficulty whatsoever" with the new Ray-Man Rotary Hose construction and Manhattan's new Type E Built-In Leak-proof Coupling.

The Streamlined Type E Coupling embodies the new "Lip-Lok" Pressure Sealing Flange. Any tendency for pressure to escape forces the "Lip-Lok" to seal *tighter*. This makes a safer, longer lasting connection than ever before possible.

Specify Flexible RAY-MAN Rotary Hose and the Safe Type E BUILT-IN COUPLING.

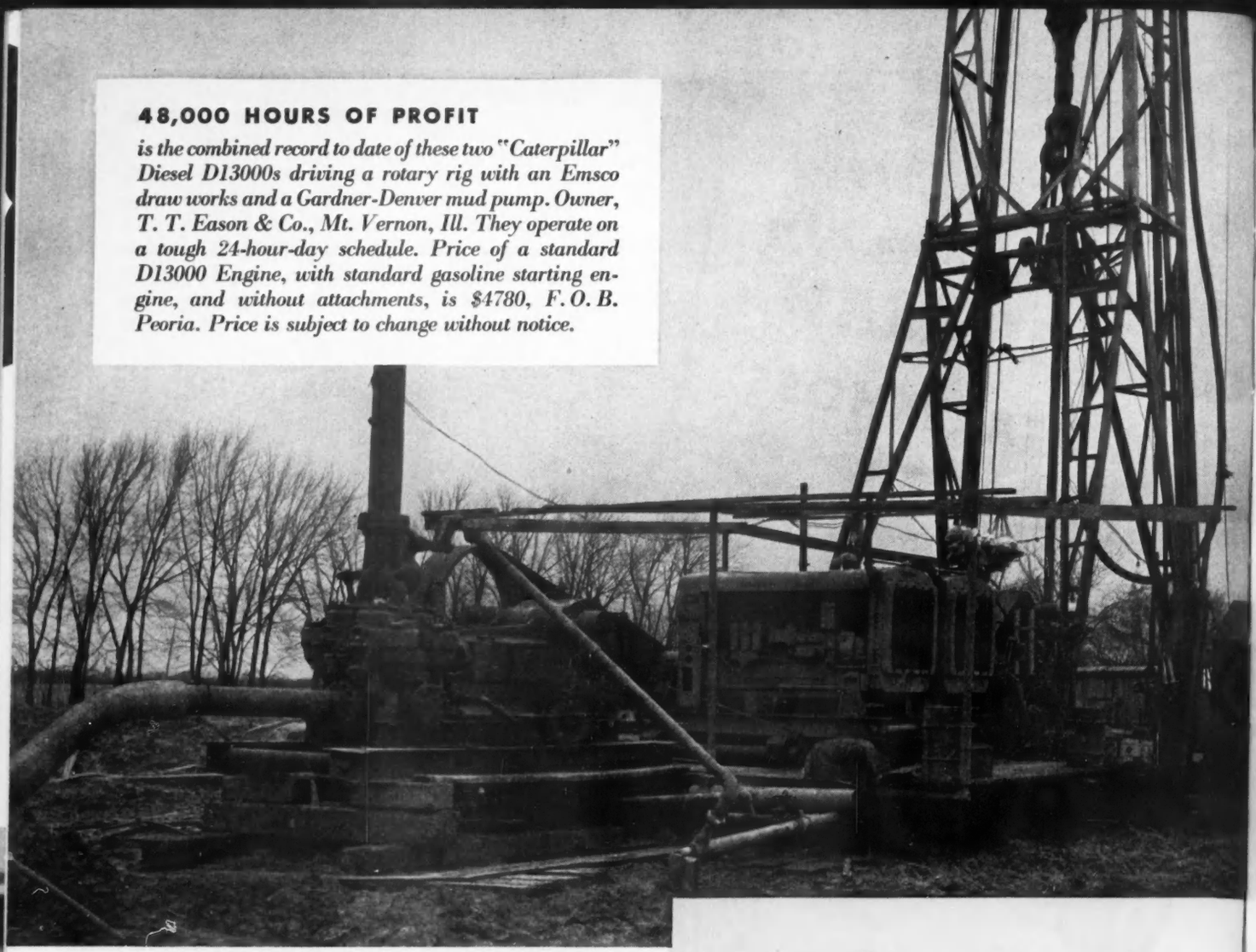
THE NEW HOSE HAS 6 MAJOR FEATURES:

1. Is extremely flexible
2. Holds steady in the derrick—resists pulsation under pressure
3. Lasts longer because of balanced, engineered construction
4. Handles easier in moving from hole to hole with less likelihood of damage
5. Has G.O.P. Flexlastics tube for all methods of drilling, including drilling-in with oil or oil-base mud
6. New built-in coupling with "Lip-Lok" Seal

RAYBESTOS-MANHATTAN INC.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION PASSAIC, NEW JERSEY



48,000 HOURS OF PROFIT

is the combined record to date of these two "Caterpillar" Diesel D13000s driving a rotary rig with an Emsco draw works and a Gardner-Denver mud pump. Owner, T. T. Eason & Co., Mt. Vernon, Ill. They operate on a tough 24-hour-day schedule. Price of a standard D13000 Engine, with standard gasoline starting engine, and without attachments, is $4780, F. O. B. Peoria. Price is subject to change without notice.

"CAT" Diesel owners don't guess

THERE are mighty few "ifs," "buts" or "maybes" when "Caterpillar" Diesel Engines take on a drilling job. Hole usually goes down, "come hell, rock or high water." As Driller Storveck, of T. T. Eason & Co., picturesquely puts it, "I'd rather use 'Caterpillar' Engines than any other make. They've got plenty of power, and they stand up like the Rock of Gibraltar."

It's the sort of sentiment expressed by "Caterpillar" users the world over . . . because they don't have to guess. They *know* their engines are DEPENDABLE—fundamentally, because they're built well; secondly, because they're backed up by an expert and thoroughly equipped dealer organization that's always available to watch over them and to provide quickly any parts or mechanical service they may need during their long life.

For interesting descriptive and case-history literature about "Caterpillar" Diesels in the oil fields, send in this coupon. There is no obligation.

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Check the down-the-hole advantages of patented Shell-developed

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In your next drilling well it can:

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E Cut rig time formerly required for conditioning mud.

F Bring you best possible results through competent service at the well.

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- Texas' largest insurance safety engineering organization.
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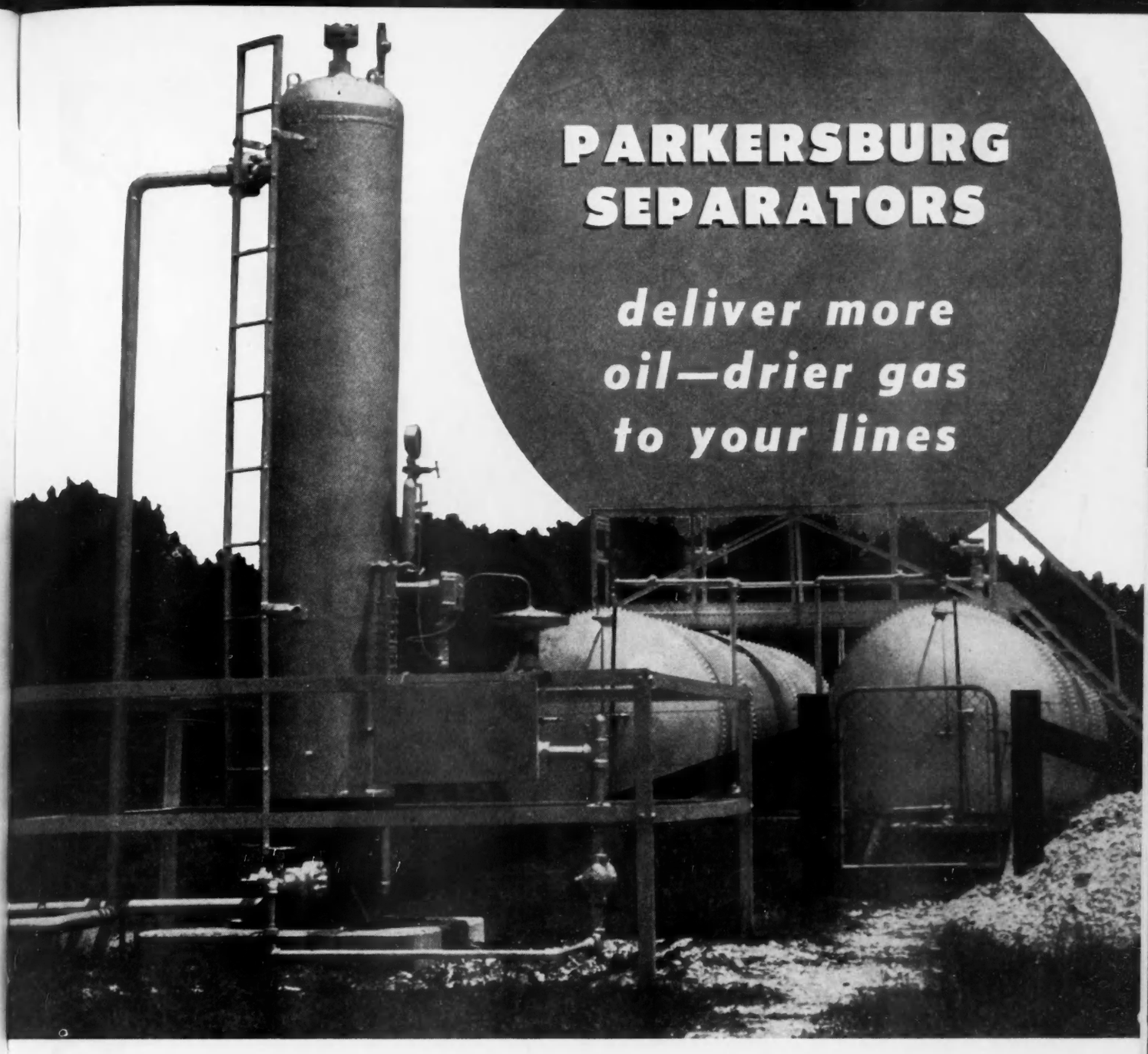

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deliver more oil—drier gas to your lines

It's what comes out of your separator that's important. That is why Parkersburg Separators are first choice. Operators want the greater volume of oil and drier gas which can only be obtained by Parkersburg's triple separating action. Comparative tests prove it!

1. Centrifugal action of the fluid and gas from the time it enters the separator until discharged maintains a continuous separating process.
2. Contraction and expansion of the gas due to increasing and decreasing velocity constantly removes moisture from the gas as it passes through the specially designed baffle plates and vanes.
3. Impingement or wiping effect of the gas on the surface of the interior parts as it passes through the separator further removes moisture from the gas.

Thus, fluid and gas is in a constant state of separation as it moves through the separator. With such effective and continuous separating action, there can be no doubt as to why Parkersburg Separators deliver more oil and drier gas to your lines.

Ask your nearest Parkersburg Representative for complete facts about Parkersburg Separators before you install your next separator.

4904

THE PARKERSBURG RIG & REEL CO.
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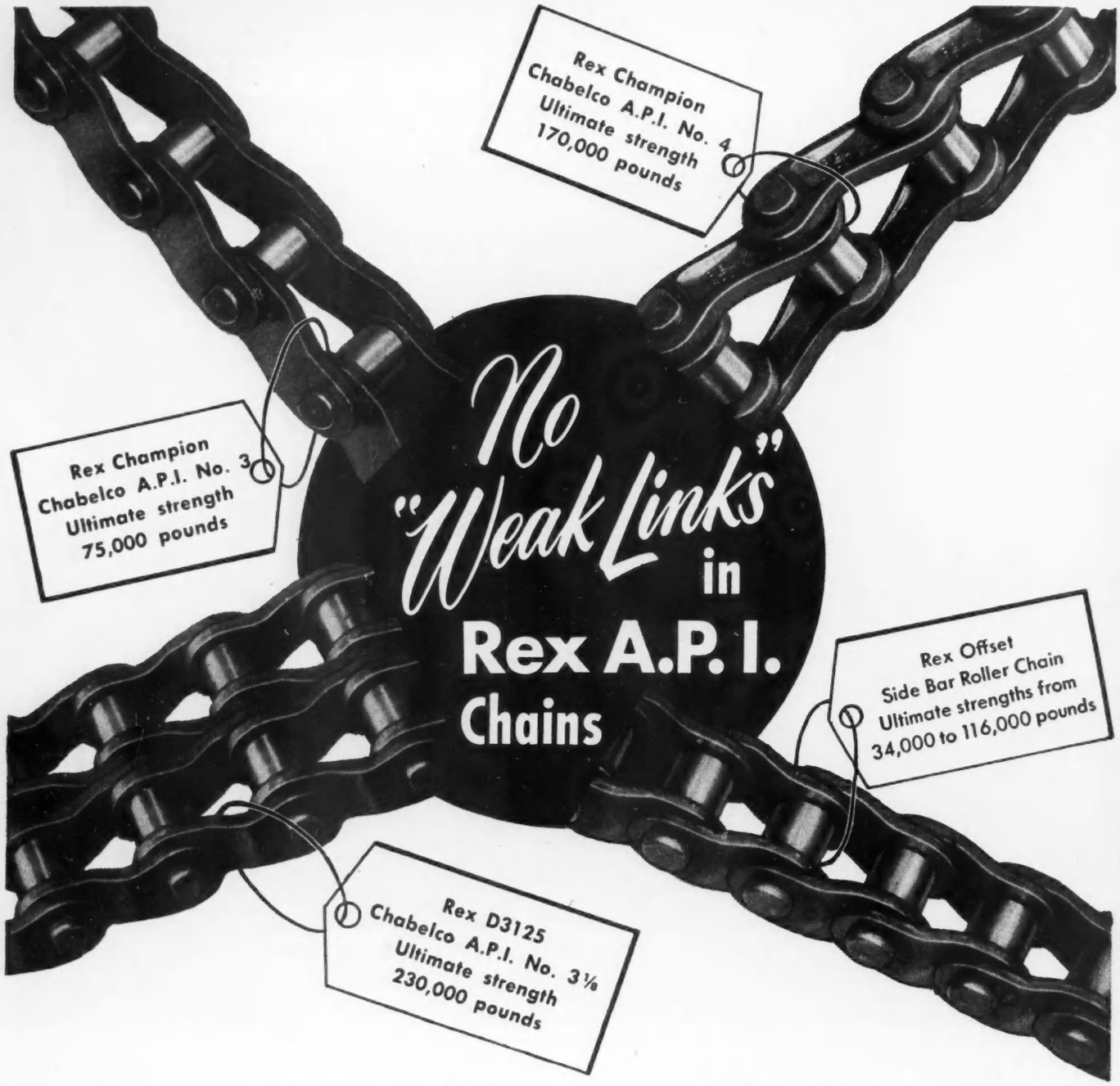

Every link in every strand of Rex Oil Field Chain is designed and built for strength and service. Just look at these husky chains and check their outstanding features:

* **All parts made of carefully selected alloy steels accurately heat-treated for maximum strength and wear-resistance.**
* **Pins and bushings hardened and ground to close tolerances for precise fit and long wearing life.**
* **The Rex Unit-Link. All parts assembled by carefully controlled pressures to assure balanced force fits . . . put together to stay.**
* **Side bar holes machine-finished for accurate pitch . . . and to assure full bearing between parts.**
* **Effective lubrication system that puts the oil where it is needed.**

Add them all up and you'll see why Rex Oil Field Chains will last longer . . . give you more for your drilling dollar. Your Rex Field Engineer or local supply store will be glad to show you the many plus advantages you get with Rex Chains. Or, if you prefer, write to Chain Belt Company, 1639 West Bruce Street, Milwaukee 4, Wis.

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REX OIL FIELD CHAINS

the chains that have grown up with the oil fields

When you protect your equipment against corrosion, it's like putting money in the bank, and you can protect it with RUST-BAN...this is not a single product but a group of protective coatings, each designed to meet specific corrosion problems of oil producers, pipe lines and refineries.

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Rust-Ban 305 for hot metal surfaces,

Etc., etc., etc. Ask for recommendations for your job.

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IT'S A HUSKY

Mild wells? Non-corrosive wells? Choose the Bethlehem XX Copper-Bearing Sucker Rod.

A husky if there ever was one, the Bethlehem XX Rod is made of carbon steel with an addition of copper. It's fully normalized, and conforms to A.P.I. specifications. It's economical, too, because it has what it takes to minimize down time. Comes with carburized, hardened-and-ground carbon-steel couplings, or with regular carbon-steel couplings (ground but not hardened).

Chances are you can put the Bethlehem XX Rod to good use in several wells. Why not talk it over with a Bethlehem engineer? All you need do is contact the nearest Bethlehem Sales Office, or write to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

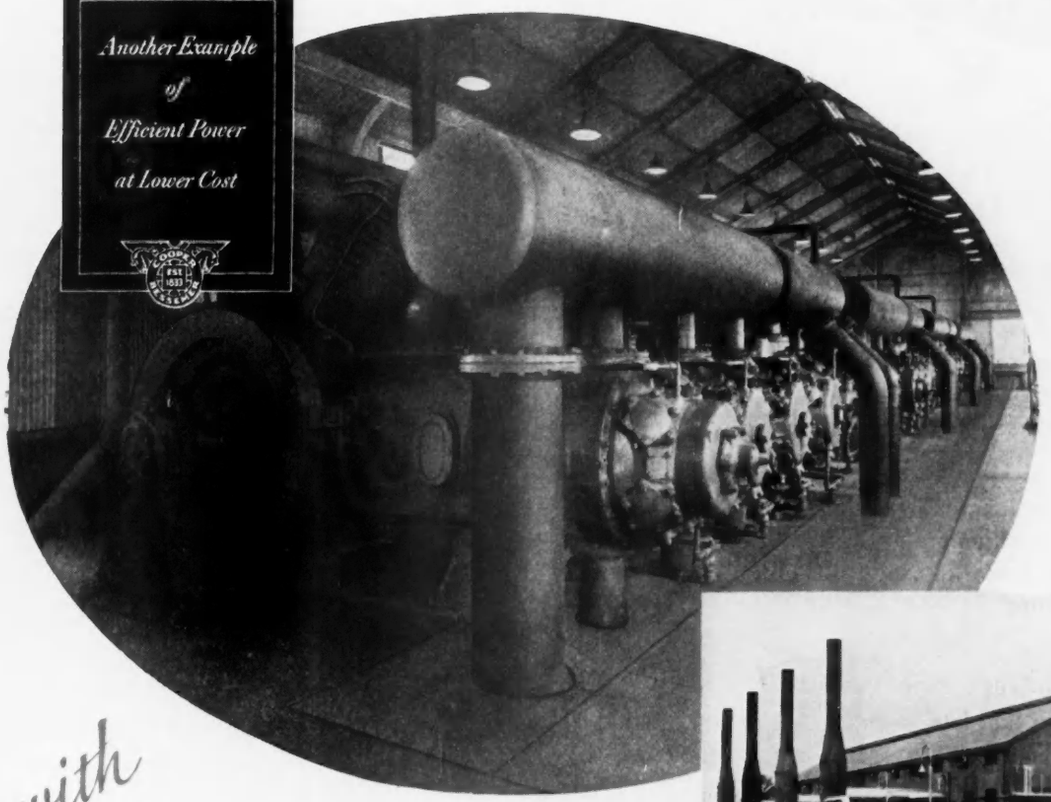
IT'S EASY TO IDENTIFY. By means of this circular depression in pin end, the Bethlehem XX Copper-Bearing Sucker Rod can easily be identified, regardless of well wear.

BETHLEHEM *Sucker Rods*

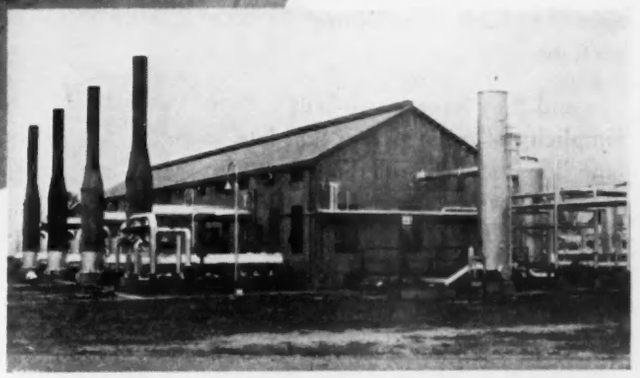
BETHLEHEM STEEL

New Delhi plant makes the most OF COMPRESSOR POWER

Another Example of Efficient Power at Lower Cost



Automatically controlled at this new plant in the Delhi field, these four Cooper-Bessemer 1000 hp GMVs each have 5 compressor cylinders for 3-stage compression from 10 inches vacuum to 550 psi. Plant is now processing some 14 million cu. ft. of gas daily from 350 wells.



with GMV Automatic Control

About 14 million feet of gas is processed daily . . . and with exceptionally high recovery of hydrocarbons . . . at a new natural gasoline plant in the Delhi field of Louisiana. The plant construction and operation is under the supervision of the Sun Oil Company.

This capacity is reached with only four 1000 hp Cooper-Bessemer GMV compressors . . . and will soon be increased by the addition of a fifth unit, bringing the plant total to 5,000 GMV horsepower.

Here, as in many other GMV installations, automatic control greatly simplifies the operation. Engine speed is automatically adjusted by speed and pressure controls for continuous output at maximum capacity as influenced by gas supply. Yes, the operators are making the most of compressor capacity.

As you plan your future operations, it might pay you to look into the features that have been developed for the automatic control of Cooper-Bessemer V-angles — new, often exclusive features that broaden control limitations and provide for greater-than-ever economies. But back of it all, remember, these modern units have the wide flexibility, dependability, and smooth running characteristics that are *first* essentials to success in automatic operation.

The Cooper-Bessemer Corporation

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New York City Washington, D. C. Bradford, Pa. Parkersburg, W. Va. San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los Angeles, Calif. Caracas, Venezuela Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

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VICTAULIC COUPLINGS AND FULL-FLOW FITTINGS SAVE MONEY!...TIME!...LABOR!

VICTAULIC COUPLINGS add flexibility to any piping system—allowing pipe lines to follow construction and land contours without costly, engineered-alignment.

. . . they also form a union at every joint—permitting quick, easy removal of fittings or pipe lengths for repair or replacement *without damage to pipe ends, without having to back off adjoining sections.*

. . . and they have a two-bolt simplicity of construction that lets pipe lines be assembled *without specially trained labor—and with a standard T-wrench the only tool needed.*

VICTAULIC FULL-FLOW ELBOWS, TEES, and other Fittings have wide-sweeping turns and true-circular inner walls that reduce frictional losses to a minimum . . . increasing pipeline output *at lower pumping costs!*

AND OUR "VIC-GROOVER" grooves pipe ends twice as fast—*with only half the effort of ordinary pipe threaders!*

WRITE TODAY for these two: Victaulic Catalog and Engineering Manual No. 44 . . . "Vic-Groover" Catalog No. VG-47.

Sizes—¾" through 60"

FOR FULL ECONOMY...MAKE YOUR PIPING SYSTEM ALL VICTAULIC!

SELF-ALIGNING PIPE COUPLINGS

VICTAULIC

EFFICIENT FULL-FLOW FITTINGS

VICTAULIC COMPANY OF AMERICA

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Victaulic Co. of Can. Ltd. 200 Bay St., Toronto 1

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THE OIL MAN'S CALENDAR

APRIL	
4– 5	Industrial Accident Prevention Association Convention, Royal York Hotel, Toronto, Canada.
4– 6	American Gas Association, Distribution Motor Vehicle and Corrosion Conference, Netherlands-Plaza Hotel, Cincinnati.
11–14	National Association of Corrosion Engineers, Netherlands-Plaza Hotel, Cincinnati.
12–14	Southwestern Gas Measurement Short Course, College of Engineering, University of Oklahoma, Norman.
18–20	Midwest Power Conference (11th Annual Meeting), Hotel Sherman, Chicago.
20–22	Southern Gas Association Convention, Buena Vista Hotel, Biloxi.
22–23	Colorado School of Mines, 15th Annual Engineers' Day, Golden, Colorado.
25–28	Fourth Southern Machinery and Metals Exposition, Atlanta Municipal Auditorium, Atlanta.
26–28	Petroleum Industry Electrical Association-Petroleum Electrical Supply Association, 21st Annual Convention, Mayo Hotel, Tulsa.
27–29	American Petroleum Institute, Eastern District Meeting, William Penn Hotel, Pittsburgh.
MAY	
3– 4	Independent Petroleum Association of America, Mid-Year Directors Meeting, New Orleans.
9–10	American Gas Association, Natural-Gas Department, Spring Meeting French Lick Springs Hotel, French Lick, Ind.
9–11	Interstate Oil Compact Commission, Spring Quarterly Meeting, Roosevelt Hotel, Jacksonville, Fla.
9–11	Liquefied Petroleum Gas Association, Annual Convention and Trade Show, Palmer House, Chicago.
12–13	American Petroleum Institute, Division of Production, Pacific Coast District Meeting, Biltmore Hotel, Los Angeles.
26–27	American Petroleum Institute, Rocky Mountain District, Gladstone Hotel, Casper, Wyoming.
26–27	The Natural Gas and Petroleum Association of Canada, Annual Meeting, Hotel London, London, Ontario.
30–31–June 1	Southern Gas Association, Fourth Annual Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Texas.
JUNE	
5– 7	Petroleum Equipment Suppliers Association, 14th Annual Meeting, Broadmoor Hotel, Colorado Springs, Colo.
9–11	National Oil Scouts and Landmen's Association, 26th Annual National Meeting, Shamrock Hotel, Houston.
16–17	Pennsylvania Grade Crude Oil Association, Annual Meeting, Hotel William Penn, Pittsburgh.
SEPT.	
14–16	National Petroleum Association, Hotel Traymore, Atlantic City, N. J.
19–21	American Association of Oilwell Drilling Contractors, Ninth Annual Meeting, Baker Hotel, Dallas.
30–Oct. 1	Colorado School of Mines, 75th Anniversary Celebration Conference on "Mineral Resources in World Affairs," Golden, Colo.
OCT.	
2– 5	American Society of Mechanical Engineers, Petroleum Division, 1949 Petroleum Mechanical Engineering Conference, Oklahoma Biltmore Hotel, Oklahoma City.
13–14	Texas Mid-Continent Oil & Gas Association, Annual Meeting, Rice Hotel, Houston.
NOV.	
7–10	American Petroleum Institute, 29th Annual Meeting, Stevens Hotel, Chicago.

Nomads Chapter monthly meetings: **Los Angeles,** second Wednesday, Jonathan Club, B. M. Landis, Secretary. **Houston,** second Monday, Houston Club, Harry E. Estes, Secretary. Telephone Charter 4-7611. **Dallas,** L. A. Little, Secretary, Telephone Justin 8-1726. **Tulsa,** third Wednesday, Hotel Tulsa, Anthony Gibbon, Secretary, Telephone 3-1844. **New York,** first Monday, Louis Sherry's, Norris Boulden, Secretary, Telephone WIckersham 2-1311, extension 260.

WORLD OIL

CURRENT OUTLOOK SECTION

AND NEWS ANALYSIS

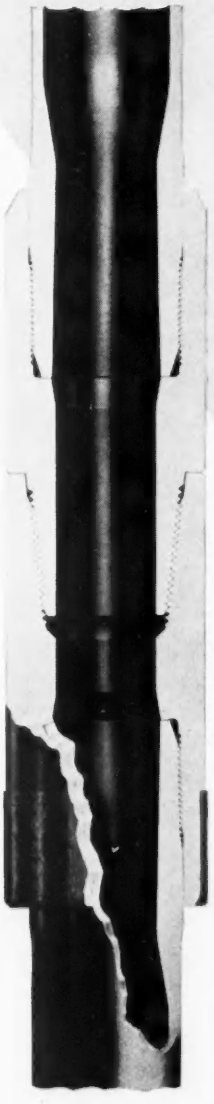
Increase your 1949 savings with

REED

Super Shrink-Grip

TOOL JOINTS

"MORE WELLS PER STRING"



Advanced metallurgy gives Reed Tool Joints an extra hardness and extra toughness that means longer wear on your rig.

And pre-lubrication infused into the tool joint threads effectively prevents galling. This means longer tool joint life and lower drill string costs.

With Reed Super Shrink-Grip Tool Joints you get even lower drill string costs because they are easily replaceable in the field. Drill pipe life is extended and transportation costs are reduced.

If you drill in abrasive areas you can extend tool joint life by specifying factory-applied "Reedite" facing. The cost is low and it will be a paying investment.

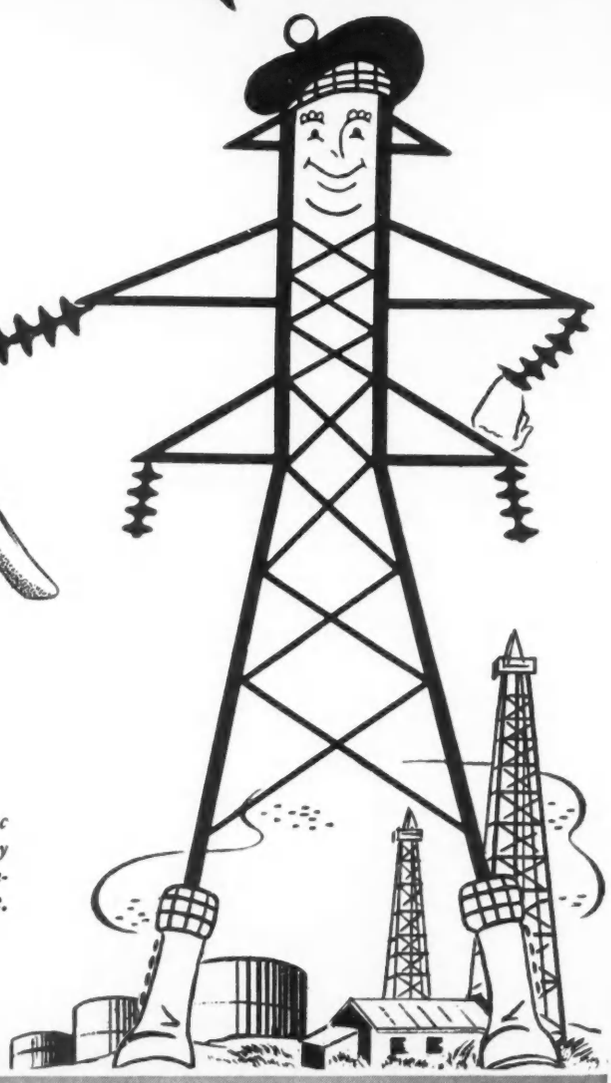
Reed ROLLER BIT COMPANY

HOUSTON 1, TEXAS

BE SAFE WITH REED

Switch to up-and-at-'em Utility Electric Power! LOW COST POWER is "on the dot" when you want it — no need to make further allowances for human error. LOW COST POWER is tireless — can take on a full twenty-four hour shift on a sustained operation, or work according to any fractional time chart without necessitating elaborate adjustments of crew schedules. Manpower thus released can be assigned to more directly productive duties. Better balance of payroll to other operating costs, automatic controls, lower investment in power equipment, lower upkeep, s-l-o-w depreciation, superior portability . . . these stack up "like a mountain" in favor of Utility Electric Power. It costs you nothing to discuss your LOW COST POWER needs with the Power Engineer. Make a date — call your nearest Utility Power Company now!

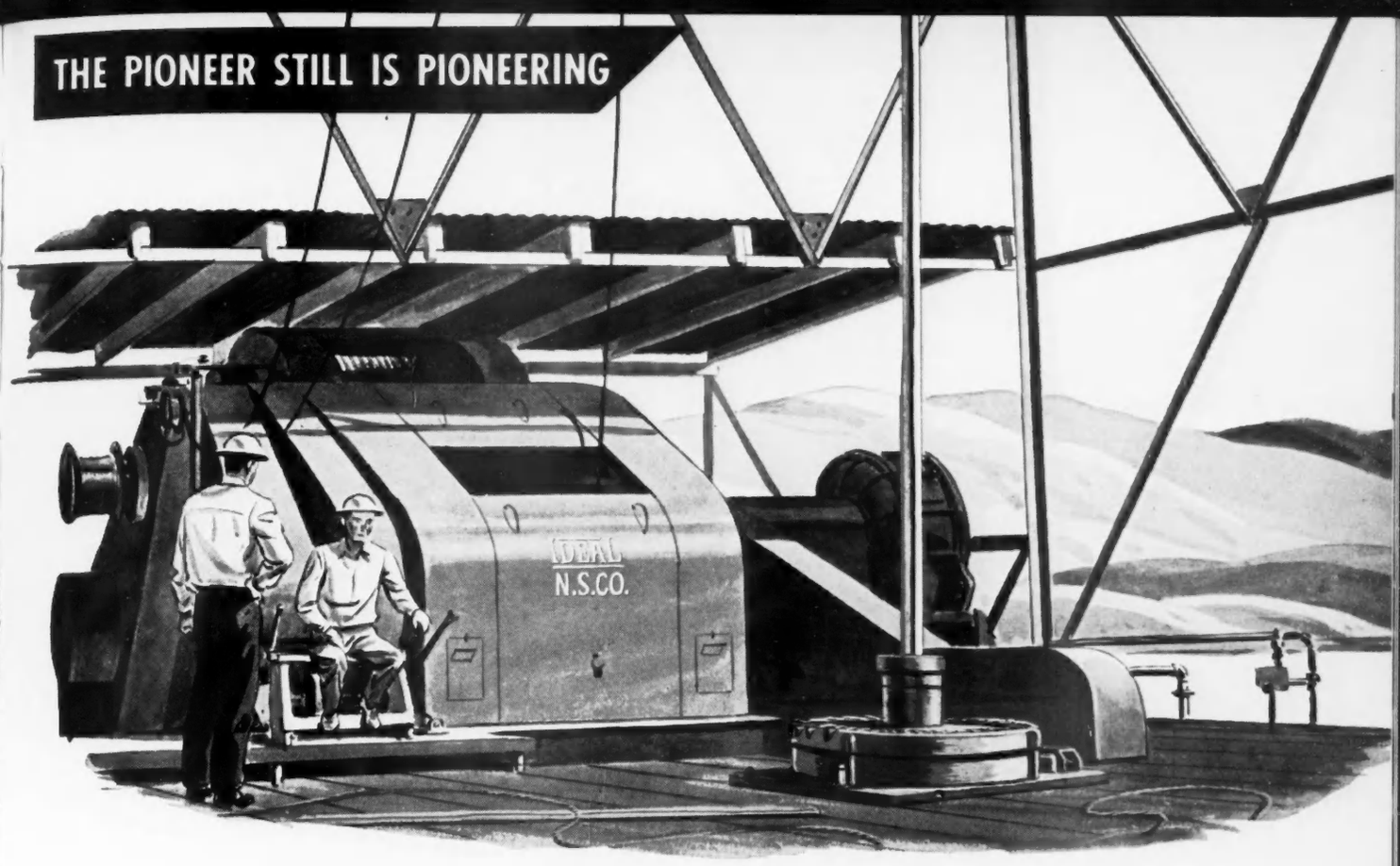
Depend upon Utility Electric Power for all-around efficiency at lowest-possible-cost maintainable by know-how management.



Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Box 1498, Oklahoma City, Oklahoma



Performance SPEAKS IN ANY LANGUAGE...

In oil fields everywhere, the words "IDEAL", "SPANG", and "SUPERIOR" on oil field machinery and equipment made by The National Supply Company have a real and very special meaning. They mean *performance*—the kind of *dependable* performance that becomes increasingly important in today's deeper drilling.

Machinery and equipment made by The National Supply Company and its divisions have helped pioneer development of practically all of the important fields. Its acceptance by oil men everywhere has grown out of National Supply's policy of *practical pioneering* in products and in service.

First of all, National Supply has always led in practical product innovations—in machinery and equipment on which oil men have learned to depend for longer life, more dependable performance, and lower drilling costs.

Secondly, National Supply serves oil men with *everything* necessary to drill and produce a well. Our oil field stores —approximately 100 of them—supply, on the spot, the thousands of products made by National Supply, as well as many related products produced by other manufacturers. And of course, National Supply field engineers are always available with friendly, expert counsel on any problem in drilling or producing a well.

It is such pioneering in service—pioneering in *performance* —that has made The National Supply Company the world's largest manufacturer *and* distributor of oil field machinery and equipment.

THE NATIONAL SUPPLY COMPANY

Executive Offices: Pittsburgh, Pa.

NATIONAL OIL FIELD MACHINERY & EQUIPMENT

SPANG PIPE
SUPERIOR ENGINES

PROTECT YOUR

Note how every pipe thread is engaged, and its root is supported by a tool joint crest. The notch effect at the bottom of the conventional V-type threads is eliminated.

FOR DRILLING ★ *THE INDUSTRY'S MOST COMPLETE*

DRILL STRINGS

Against last engaged thread failures

Last engaged thread failures are reduced to a minimum when drill-strings are made-up with Spang Double Seal Shrink Thread Drill Pipe and Tool Joints. On Spang Drill Pipe and Tool Joints, the root diameter of the pipe thread at the run out is equal to or greater than the outside diameter of the pipe. Every pipe thread is engaged and its root is supported by the crest of a tool joint thread. The notch effect at the bottom of conventional "Vee type" threads is eliminated.

What's more, Spang Shrink Thread Drill Pipe and Tool Joints have a double seal. An inner seal prevents leakage and washout through threads; an outer seal prevents entry of fluids into threads from the outside. And Spang Shrink Thread Tool Joints and Drill Pipe can be replaced right at the rig.

We will be glad to send you a fully illustrated booklet that explains in full detail all the advantages of Spang Double Seal Shrink Thread Drill Pipe and Tool Joints. It also contains practical information that tells how to increase drill string life. Write for your copy today.

THE NATIONAL SUPPLY COMPANY

SPANG-CHALFANT DIVISION

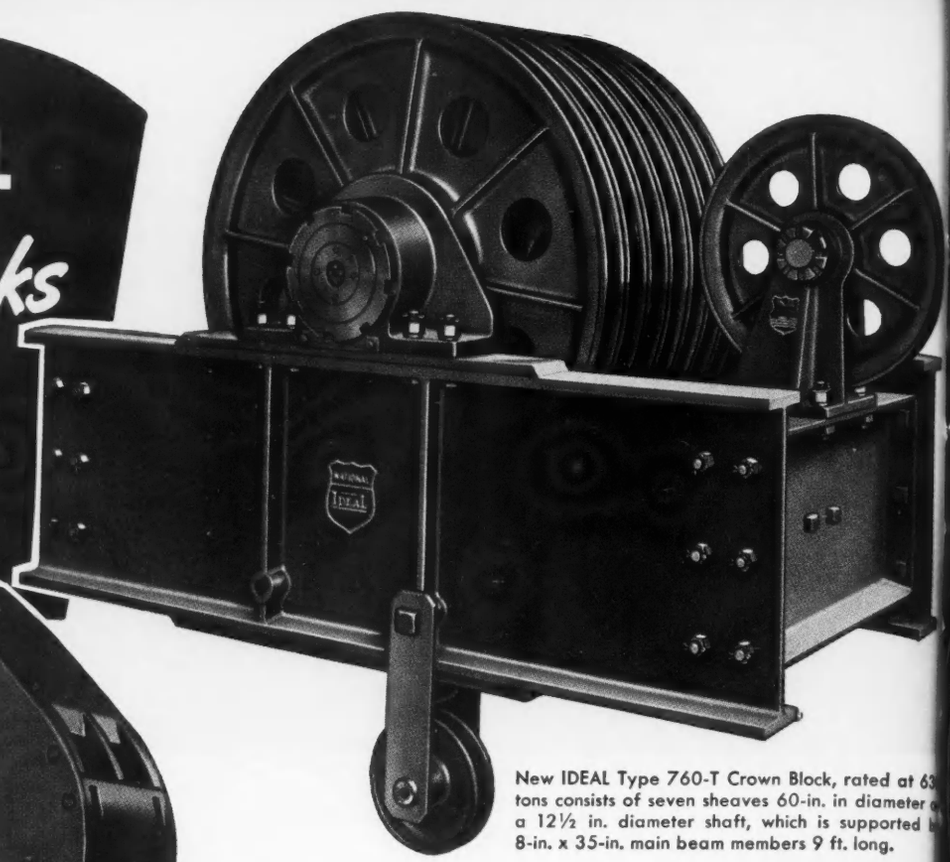
GENERAL SALES OFFICE: PITTSBURGH, PA.

DISTRICT SALES OFFICES: ATLANTA; BOSTON; CHICAGO; DENVER; DETROIT; HOUSTON; LOS ANGELES; NEW YORK; PHILADELPHIA; PITTSBURGH; ST. LOUIS; SAN FRANCISCO; TULSA

THE NATIONAL SUPPLY COMPANY NSCO — NATIONAL BLUE PRODUCTS

E LINE OF OIL FIELD EQUIPMENT ★ FOR PRODUCTION

NATIONAL builds the *Best in Blocks* FOR EVERY DRILLING REQUIREMENT



New IDEAL Type 760-T Crown Block, rated at 63 tons consists of seven sheaves 60-in. in diameter a 12½ in. diameter shaft, which is supported b 8-in. x 35-in. main beam members 9 ft. long.

New IDEAL Type 660-TD Traveling Block, rated at 540 tons, consists of six sheaves 60-in. in diameter on two 10¼-in. shafts, four sheaves above and two below, inclosed in a block 13½ ft. long, 34-in. thick, and 5 ft. 8-in. wide.

In National's IDEAL line, you'll find the right Crown and Traveling Block Combination to fit your job . . . whether you're drilling shallow, medium or very deep wells. National IDEAL Blocks are engineered to work together as a well-matched team and they are available in a wide range of types and sizes.

The IDEAL Heavy-Duty Block Combination pictured here . . . largest in the industry today . . . provides maximum safety and efficiency to solve the tough hoisting problems that are encountered in drilling wells up to 20,000 ft. And the same fine materials and craftsmanship go into all IDEAL Blocks . . . from the smallest to the largest.

Write for descriptive literature or consult your nearby National Supply representative for expert help in rigging your derrick.

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THE NATIONAL NSCO SUPPLY COMPANY — NATIONAL BLUE PRODUCTS

★ *THE INDUSTRY'S MOST COMPLETE LINE OF OIL FIELD EQUIPMENT* ★

WORLD OIL

EXPLORATION SECTION

MAGIC FINGERS

Magic is the word for the Howco caliper . . . Unerringly its sensitive "fingers" probe the side of a bore hole, note every characteristic and record their findings on camera film . . . Applications include: drilling mud and time studies, location of packer seats and sidewall coring points . . . accurate volume calculations for fill-up of cement, plastic or gravel packing jobs . . . lost circulation, fishing jobs, etc., etc. Technical papers on its uses are available on request.

HALLIBURTON OIL WELL CEMENTING CO.

DUNCAN, OKLAHOMA

At Last! A WIRE ROPE HANDBOOK FOR THE MAN ON THE JOB!

It's new . . . It's different . . . It's easy to understand

J&L STEEL

POCKET SIZE

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General Recommendations for Ropes in Use on Standard Equipment

3

This 96-page illustrated book is especially written for the machine operator who handles wire rope constantly on his job. And its handy size—4⅜" x 7½"—fits into your pocket, ready for instant reference. It's yours for the asking!

SEND FOR YOUR COPY NOW!

Jones & Laughlin Steel Corporation
417 Jones & Laughlin Building
Pittsburgh 19, Penna.

Gentlemen:

Please send me a free copy of your new handbook "Wire Rope is a Machine."

Name_____

Company_____

Address_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY (*hi-tensile steels*).

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

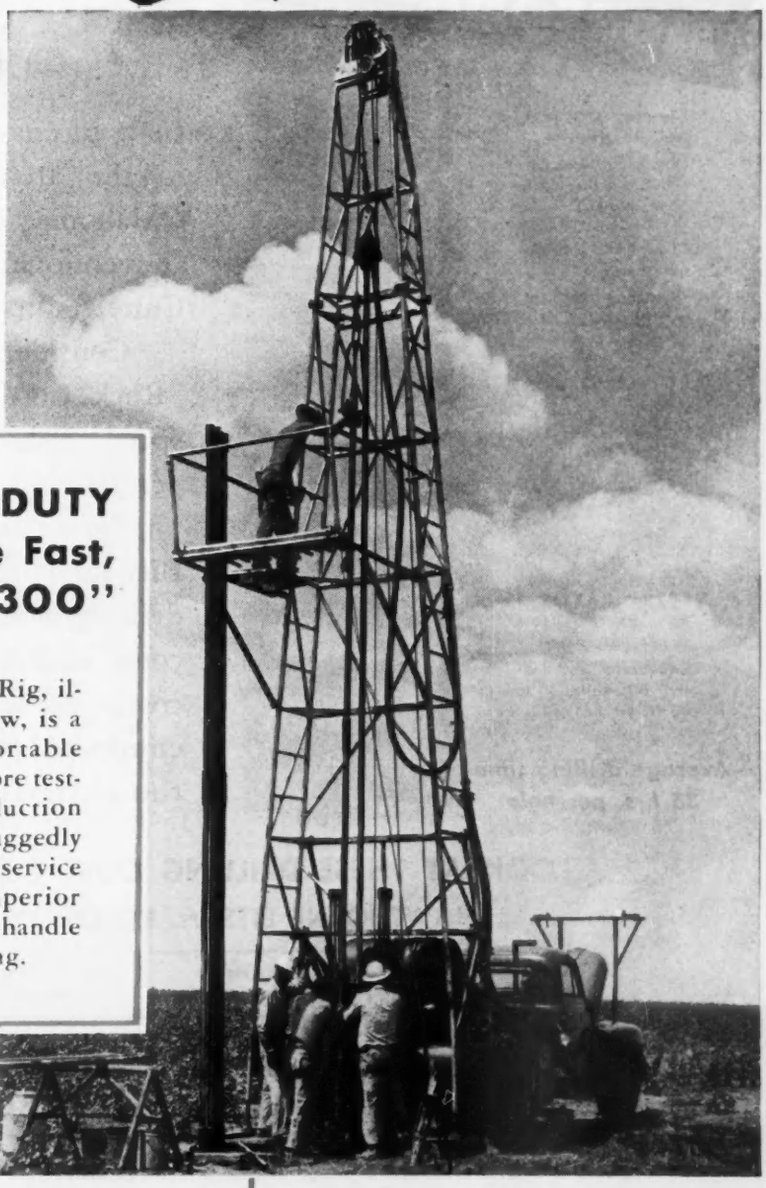
JOY MOTORIZED RIGS

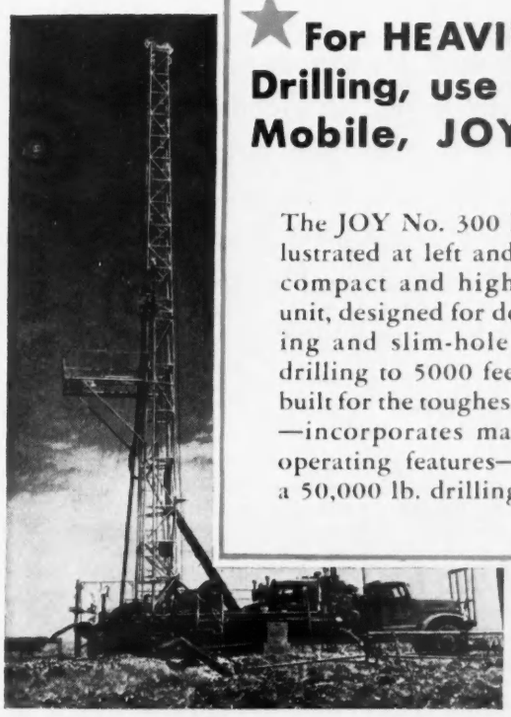
Meet any drilling requirement

★ The NEW "150" DRILL RIG

Latest Design—Top Performance!

The JOY "150" (*right*) is designed for heavy-duty seismograph, electrical logging, structure testing and shallow water well drilling to 1500 feet. It incorporates the most modern improvements in drill rig design . . . has *proved* itself outstanding in the field within its capacity range.





★ For HEAVIER-DUTY Drilling, use the Fast, Mobile, JOY "300"

The JOY No. 300 Drill Rig, illustrated at left and below, is a compact and highly portable unit, designed for deep core testing and slim-hole production drilling to 5000 feet. Ruggedly built for the toughest field service—incorporates many superior operating features—will handle a 50,000 lb. drilling string.

★ INTERMEDIATE SIZES FOR EVERY NEED—THE JOY 225, 250 and 275 DRILL RIGS

Write for Bulletins, or

Consult a Joy Engineer

W & D 02364

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

EXPLORATION DRILLERS:

...here's how HAWTHORNE BITS MORE THAN DOUBLED DRILLING SPEED!

Drilled 4500 extra feet per month
Saved $419.50 in bit costs per month
Cut drilling costs from .69 to .27 per foot

SOFT—clay, sandy clay, sand and gravel
(Hawthorne "Rock Cutter" Bits drilled 60 to 80 ft. per hr.)

SOFT—red beds with gypsum streaks
(Hawthorne "Rock Cutter" Bits drilled 60 to 80 ft. per hr.)

VERY HARD — Blaine gypsum
(Hawthorne "Rock Cutter" Bits drilled 8 to 15 ft. per hr.)

MEDIUM HARD—red beds, hard gypsum streaks, salt streaks
(Hawthorne "Rock Cutter" Bits drilled 30 to 45 ft. per hr.)

Average drilling time 35 hrs. per hole

In a recent cost analysis of exploration drilling in the all-formation Shattuck-Woodward area, Oklahoma, extensive tests were run using both conventional roller bits and Hawthorne "Rock Cutter" Bits *under identical conditions.*

Consider these amazing results: Hawthorne "Rock Cutter" Bits more than doubled drilling speed, reduced bit costs 65% and reduced cost per foot 60%.

Faster drilling with Hawthorne "Rock Cutter" Bits paid important *extra* dividends, too. Slower drilling with roller bits caused side-walls to become soaked and to cave in unless quantities of costly drilling mud were used. Hawthorne Bits eliminated need for mud and enabled crews to run electric log without difficulty.

LOOK AT THESE DRILLING COST COMPARISONS

HAWTHORNE BITS vs. ROLLER TYPE BITS

	Average Bits per Hole	Holes per Month	Total Bit Costs per Month	Total Footage per Month	Total Drilling Costs per Foot
Roller Bits	4	4	$640.00	6,000 ft.	$ .69
Hawthorne Bits	2	9	$220.50	13,500 ft.	.27

The above figures show an average saving in drilling costs of $0.42 per foot—a total saving in bit costs of $419.50 per month, resulting from exclusive use of Hawthorne "Rock Cutter" Bits.

The Shattuck-Woodward area was selected for this test because it is a typical, all-formation area. Similar—often greater—savings with Hawthorne Bits are being effected daily in many other areas.

Patents Pending

- ***See Composite Catalog or Geophysical Directory for lists, parts, prices — or write for illustrated catalog.***

HERB J. HAWTHORNE INC.

P. O. BOX 7299 HOUSTON 8, TEXAS

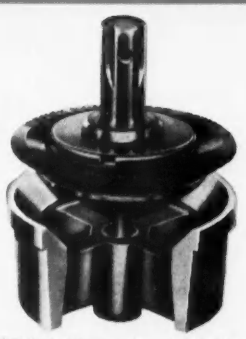
WORLD OIL

DRILLING SECTION

Operates without Attention

3 to 10 times as long!

The Bushing and long-lived insert are the reasons



MISSION *"Super-Service"* Slush Pump Valve for High Pressures

The above statement is confirmed by hundreds of field records. The MISSION Replaceable Valve Seat Bushing takes the wear, increasing seat life many times. The MISSION "Compound 308"* Insert lasts 3 to 5 times as long as regular inserts in ordinary mud, and up to 10 times as long as ordinary oil-resisting inserts in hot or treated mud, or oil and gas.

Life of bushing and insert are approximately equal. When you install a new insert, install a new bushing. This gives you practically a new valve. Available through all supply stores . . . Mission Manufacturing Co., Houston, Texas . . . Export: 30 Rockefeller Plaza, New York. European address: London, England.

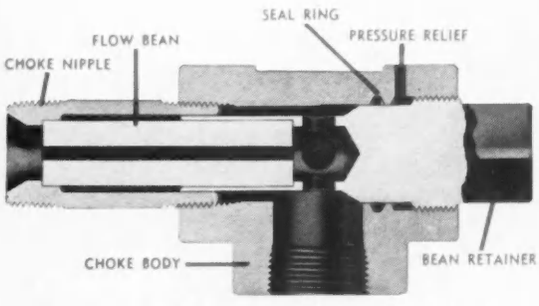
*TRADE MARK REG. U. S. PAT. OFF.

MISSION SLUSH PUMP PARTS

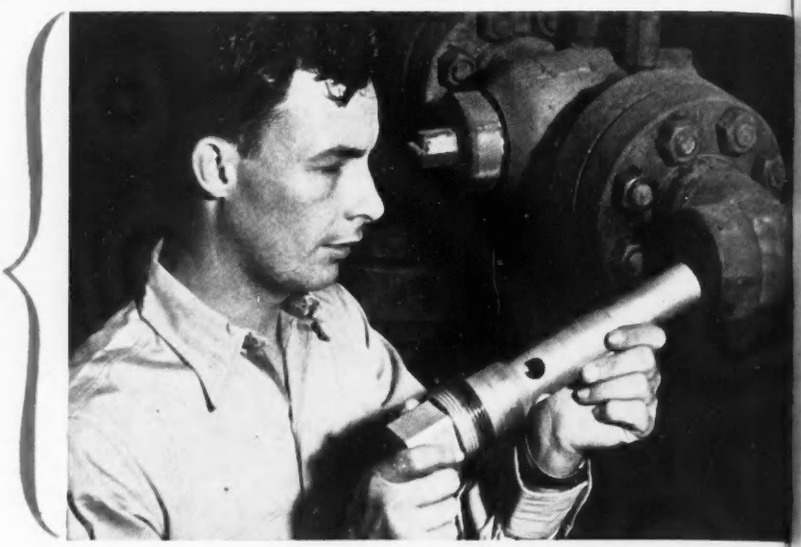
. . . have a *mission* . . . to save you money!

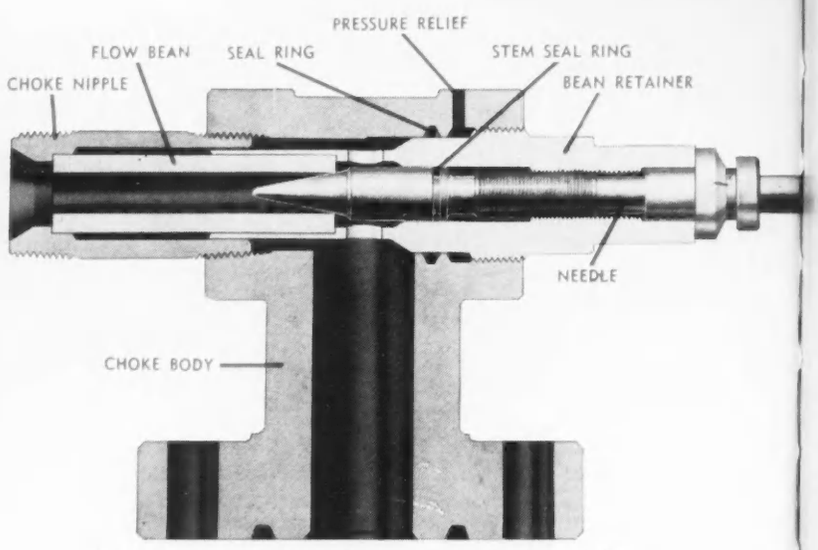
G-136

These are the NEW Cameron PRODUCTION CHOKES



POSITIVE TYPE "G"





ADJUSTABLE TYPE "G"

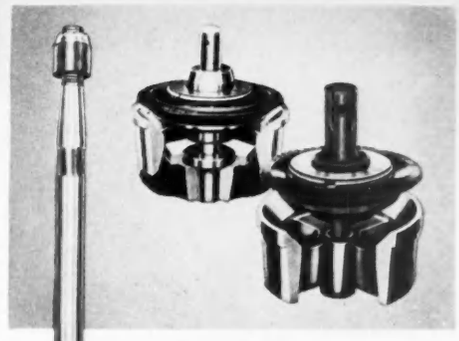
Above are presented cross-section views of the Positive and Adjustable models of the Cameron Type "G" Production Choke. The Cameron forged steel body, which is available either threaded or flanged, and in pressures up to 5000 Lbs. W.P., accommodates either the adjustable or positive assembly.

A unique feature of these new chokes is the manner in which flow beans are changed. Note that the bean retainer fits snugly around the bean so that the bean is automatically retrieved when the retainer is backed out of the body. NO BEAN WRENCHES ARE REQUIRED FOR THIS OPERATION. Choke changing is fast and easy. Note, also, that as a safety measure trapped pressure is automatically relieved as the bean retainer is backed out, but before the retainer is disengaged from the body.

Interested operators are invited to write for complete details.

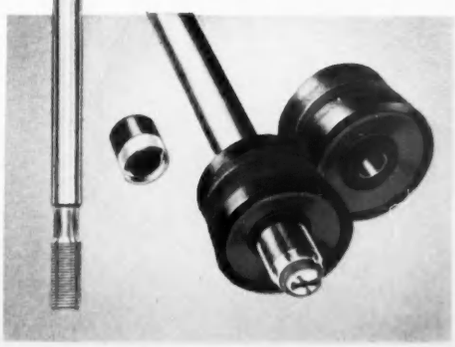
CAMERON IRON WORKS, INC.
P. O. BOX 1212 HOUSTON, TEXAS

Export: 74 Trinity place, New York, N. Y. Oklahoma: 310 Thompson Bldg., Tulsa (Telephone 28970). California: Long Beach (P. O. Box 267). Wyoming: 356 N. Wolcott St., Casper. North Louisiana: Bossier City (P. O. Box 425). Texas: Midland (Telephone 1982), Corpus Christi (Telephone 28783), Fort Worth (Telephone 46522).



MISSION Silver Top and Super-Service Slush Pump Valves.

MISSION Slush Pump Piston, Super-Surfaced* Rod, and Self-Sealing Gland Packing.



MISSION "Compound 308"* Inserts Last *3 to 10 Times Longer!*

There are two main reasons why MISSION Slush Pump Valves lead their field: (1) Our "Compound 308" Insert, which stands up 3 to 5 times as long as regular inserts in ordinary mud . . . and up to 10 times as long as ordinary oil-resisting inserts, in hot mud, treated mud, or oil and gas; (2) The replaceable seat bushing in our Silver Top Valve, which takes the seat wear . . . . Mission Mfg. Co., Houston, Texas. Export: 30 Rockefeller Plaza, New York. European address: London, England.

*TRADE MARK, REG. U. S. PAT. OFF.

G-201-A

MISSION

One-Piece Extra-Long "Rolling Dog" Slips

MISSION "Super-Speed" Power Slips . . . our One-Piece "Rolling Dog" Slips mechanically operated . . . save hours on round trips, increase crew efficiency and safety.

MISSION "Rolling Dog" Slips *Speed Drilling!*

Every factor that makes for greater speed on the drilling rig . . . saves *money!*

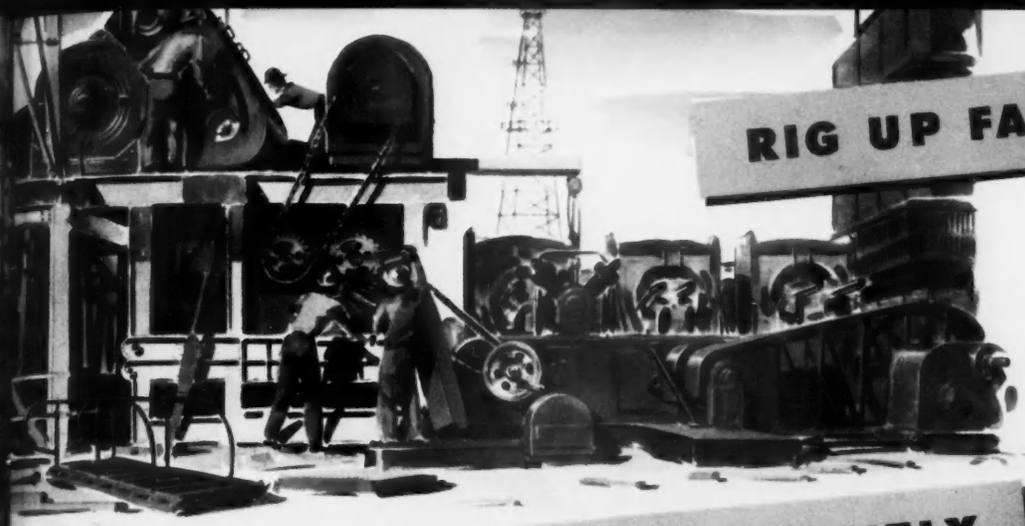
MISSION "Rolling Dog" Slips save time . . . increase speed . . . because they engage the pipe and release it *instantly!* They take hold *right now,* without dangerous slippage and chatter. They let go the instant pipe is raised, each individual dog rocking upward and backward. No sticking and freezing, to cause delay and grief.

Available through all supply stores . . . Mission Manufacturing Co., Houston, Texas. Export Office: 30 Rockefeller Plaza, New York. European address: London, England.

MISSION HAND SLIPS

. . . have a *mission* . . . to save you money!

G - 201 - B



RIG UP FASTER

On barge, piling or land installations, Emsco "J" rigs require a minimum of set-up time. Exclusive "stair-step" design permits placing of engines, compounding transmission and selective speed transmission at any desired level. Rig may be flat set, medium-step or full stair step to meet varying height substructures.

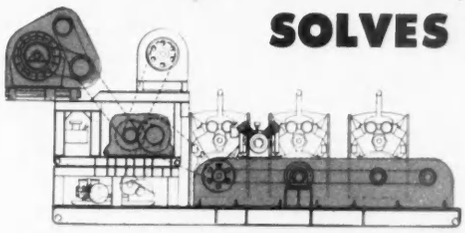
DRILL MORE EFFICIENTLY

Unlimited operating flexibility . . . that's the key to the deep drilling efficiency of Emsco "J" rigs. These rigs may be powered by two, three or four engines of a wide variety of types and makes. Two slush pumps may be driven at different speeds simultaneously.

TRANSPORT EASIER

Emsco "J" rigs consist of three basic packages—drawworks, selective speed transmission and compounding transmission. All units meet road clearance requirements. "Stair-step" design eliminates need of heavy bulky subbases under engines and compounding transmission. Hauling weight is substantially reduced.

Packaged Design OF EMSCO "J" RIGS SOLVES DEEP DRILLING PROBLEMS



EMSCO "J" SERIES drilling Rigs consist of three basic units—drawworks, selective speed transmission and compounding transmission. This "packaged design" has increased the efficiency of every phase of the drilling operation, from the original rigging-up to the final tear down and move to another location. Long "V" belt and chain drives are eliminated. Rig requires a minimum of set-up time. Completely air-operated controls centralized at the driller's position speed up drilling operations. Rig design permits use of any or all of the following accessories: sand reel; hydromatic or dynamatic brakes; washdown pump; any type of feed-off device; generators; and compressors.

For rigs engineered to the drilling needs of today and tomorrow, talk to your nearest Emsco representative. He will show you how Emsco "J" rigs can lower your deep drilling costs.

CONTINENTAL

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS • *Export Division:* 30 Rockefeller Plaza, NEW YORK, N. Y. • *Representatives:*
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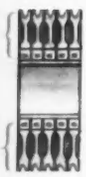
JAVA • MEXICO • PERU • TRINIDAD • VENEZUELA

Large diameter alloy steel sheaves reduce bending stresses in line. Sheaves and bearings are interchangeable between crown and traveling blocks. Available with 50 or 60 inch sheaves.

Flame-hardened grooves maintain ideal sheave groove contour minimizing wire line wear. Field reports show that mating M-Series Crown and Traveling Blocks increase wire line life by 40% or more.

Large number of straight roller bearings running in 27½" O.D. race provide maximum load capacity per unit of width. Built-in thrust shoulders reduce width of block and eliminate use of hazardous thrust washers.

Lines are perfectly parallel between mating crown and traveling blocks. This minimizes lateral chaffing of line. Large diameter roller bearings assure freely rotating sheaves and fast dropping empty blocks.

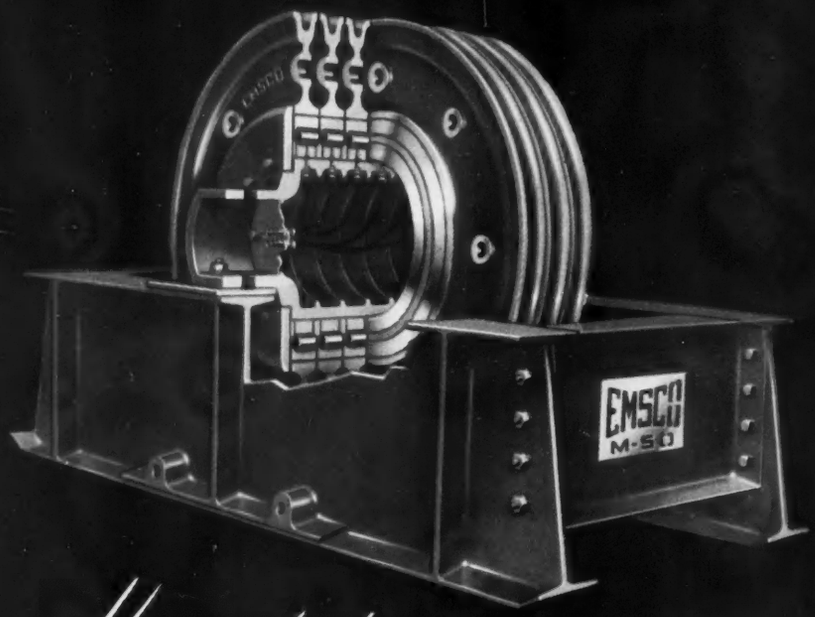


Close proximity of bearings to rope grooves prevent tilting of block and minimize wear on wire line, bearings and sheaves. Many operators report that Emsco M-Series blocks more than pay for themselves in reduced wire line service costs.

Ask your nearest Emsco representative to show you how Emsco M-Series Crown and Traveling Blocks can lower your deep drilling costs. New bulletin available upon letterhead request.

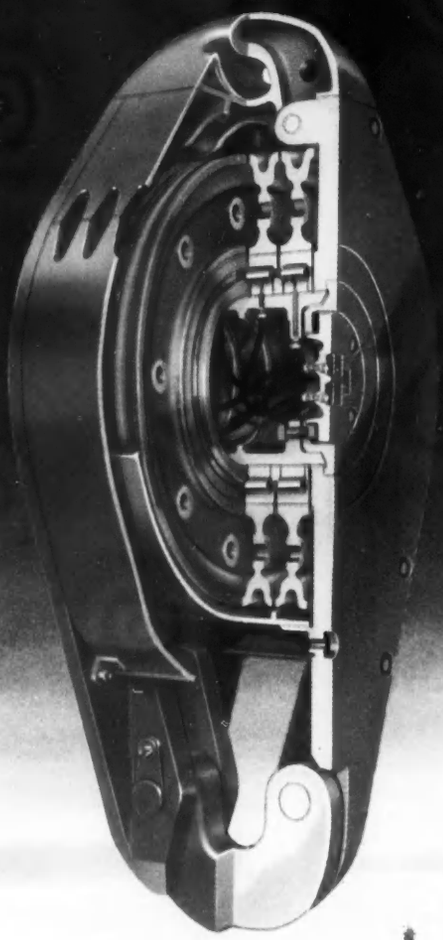
EMSCO

REG U.S. PAT. OFF.



Here's Why YOU GET LONGER WIRE LINE LIFE WITH

EMSCO M-SERIES CROWN & TRAVELING BLOCKS



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Houston, Texas . LOS ANGELES, CALIFORNIA . Dallas, Texas

DISTRIBUTOR:

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"PACEMAKERS IN OIL FIELD EQUIPMENT DESIGN"

WORLD OIL

PRODUCTION SECTION

AR 204

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Lane-Wells Radioactivity Well Logging "sees" through casing and cement to reveal character and thickness of all formations, show porous zones, find possible cased-off pay zones, detect fluid-bearing zones, locate casing seats, and liner overlaps make measure checks, check on all squeeze jobs, and tie all information to fixed immovable reference points – the casing collars

A COMPLETE PICTURE OF YOUR WELL

LANE WELLS Radioactivity Well Logging

..gives the Only Complete Record possible through Casing!

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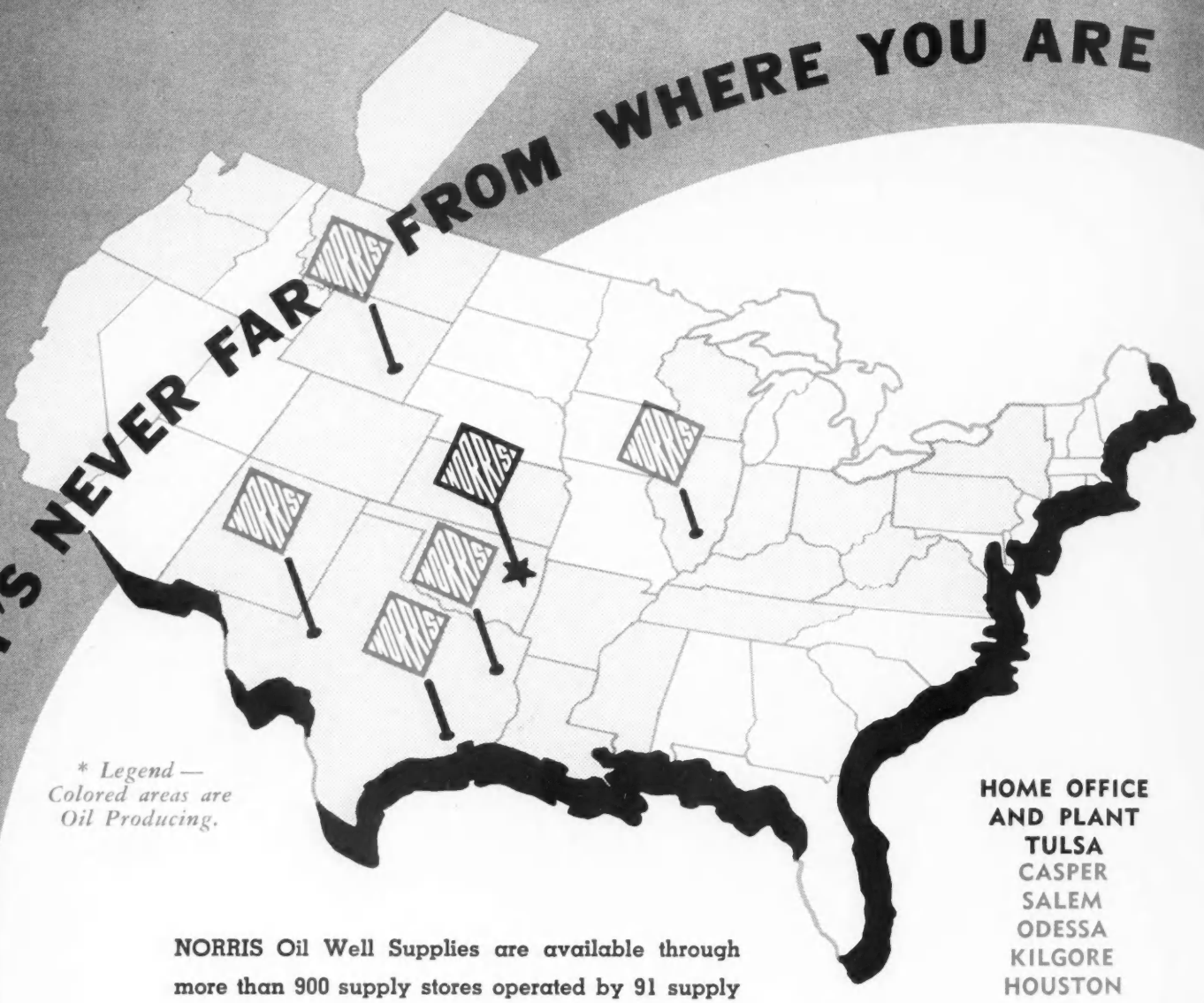
IT'S NEVER FAR FROM WHERE YOU ARE



** Legend — Colored areas are Oil Producing.*

HOME OFFICE AND PLANT
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CASPER
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ODESSA
KILGORE
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NORRIS Oil Well Supplies are available through more than 900 supply stores operated by 91 supply companies in 23 states. NORRIS distributors and five stock distribution points are strategically located to serve all oil producing areas more efficiently. These NORRIS stocks are being maintained to enable your supply company to better serve you.

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Since NORRIS QUALITY PRODUCTS *1882*

WEST COAST DISTRIBUTORS:
Swaged Nipples and Bull Plugs
REPUBLIC SUPPLY COMPANY OF CALIFORNIA, Los Angeles
Norris Sucker Rods
HICKEY PIPE & SUPPLY COMPANY, Los Angeles

FAMOUS PITTSBURGH *hydro-lube** NOW IN BRONZE!

PITTSBURGH

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Hard-working Money-saver

Jensen leadership in the field didn't just happen. It was possible only after a vast store of research, study, and practical experience had been focused on the design and construction of a superior pumping unit. And it was retained only after Jensens had proved themselves in the field to be efficient, rugged performers . . . hard-working money-savers. Jensen Pumping Units have been just that for twenty-nine years.

Your near-by Jensen dealer will be happy to give you more specific proof of Jensen leadership, or write to Coffeyville for the facts and figures in the form of free, informative literature. Why not write today? Letters answered promptly.

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Bros. Mfg. Co., Coffeyville, Kan.

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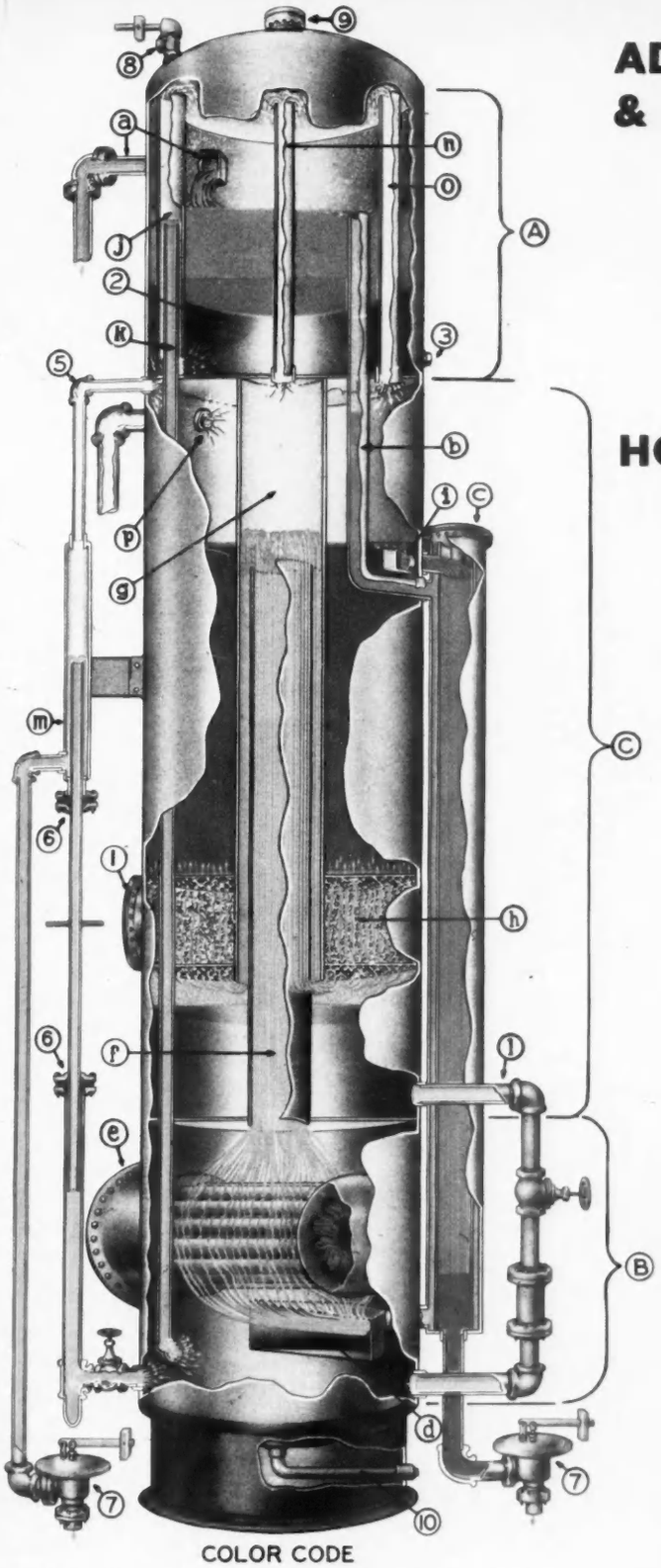
BS&B TYPE "F" TREATERS



COLOR CODE

● EMULSION ● WATER ● TREATED OIL GAS

ADVANTAGES OF BLACK, SIVALLS & BRYSON TYPE "F" TREATERS:

Separate Drainage of each of three Treater Compartments—Firebox Inspection can be completed in *less than an hour*—entire job of removal, inspection, cleaning, replacement and resumption of production can be done in *less than four hours* by *two men*—Higher gas separating capacity—Large settling section—Greater heating capacity!

HOW IT WORKS

Production from well enters classification section (A), through side inlet (a). Cold gas separates from liquid. Emulsion and water stratify in free water knockout part of section.

EMULSION

Emulsion flows from classification section through conductor pipe (b) to outside heat exchanger (c). From heat exchanger emulsion passes into heating section (B). It is discharged into heating section through distributor pan (d) under removable firebox (e). Emulsion is heated as it passes upward through salt water bath around firebox. Heated emulsion moves upward through flume (f). Gas evolved from heating is allowed to escape at top of flume. Gas-free emulsion flows downward through outer flume (g) and is finally discharged into quiet settling section (C). Final separation of emulsion into treated oil and water is completed in this section. Oil passes upward through filter bed (h). Treated oil is removed through outlet (i) to heat exchanger (c). It passes to stock tanks as treated oil.

FREE WATER

Free water, which has accumulated in classification section, passes through fixed syphon (j), down conductor pipe, to point of discharge near bottom of treater. Small particles of oil that may be entrapped in free water are freed and pass into emulsion stream around firebox. Some water, due to heating, will separate from emulsion in heating section and remain in lower part of treater. Water that is separated in settling section passes back to bottom of treater through outside water equalizer pipe (l). All of water accumulated during treater operation is now at the bottom of treater, and is withdrawn through outside adjustable water syphon (m).

GAS

When original well stream entered classification section cold gas was separated from liquid. Hot gas, freed when emulsion was heated, passes upward through flume (f) and gas equalizer pipe (n) to classification section. Hot gas mixes intimately with the cold gas. The resulting cool mixture causes condensation of light fractions which drop back into emulsion. Cool gas then passes through pipe (o) to gas zone above oil settling section. Here further condensation may occur. Dry gas is finally removed through side outlet (p).

EFFICIENCY RELIABILITY

FOREIGN INQUIRIES INVITED Cable Address: BLACK, KANSAS CITY, U.S.A.

BLACK, SIVALLS & BRYSON, INC.

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Type F Treaters

Handles Toug
Emulsions Fast

B S & B Treaters are engineered to sav
production time by shortening shutdown
to deliver the maximum output of gas an
oil of highest gravity to tanks at the lowe
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available in four standard sizes . . . 4, 6,
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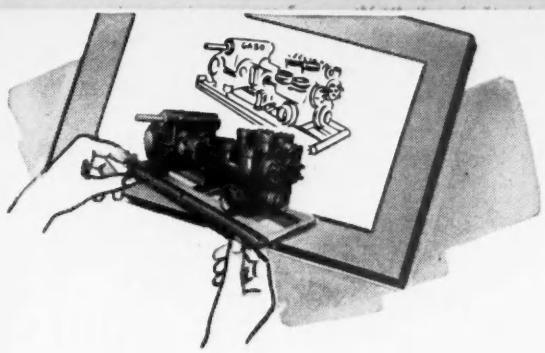
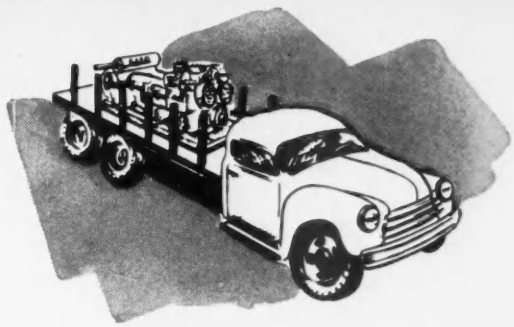
WORLD OIL

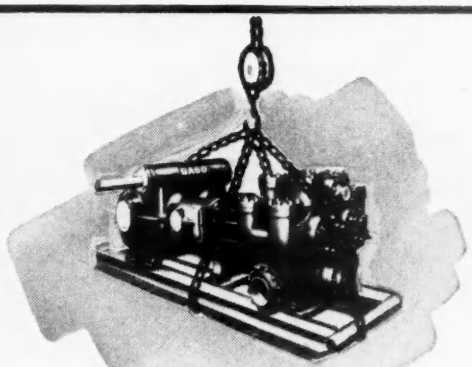
PIPE LINE SECTION



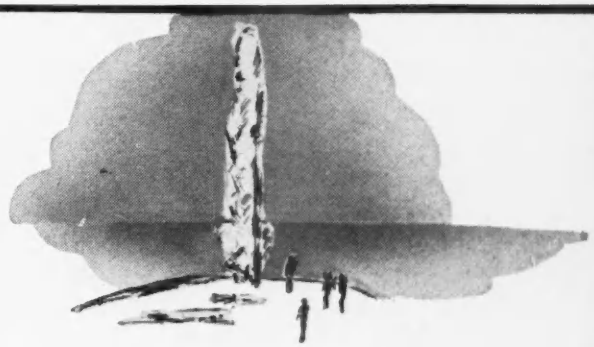
Adaptability



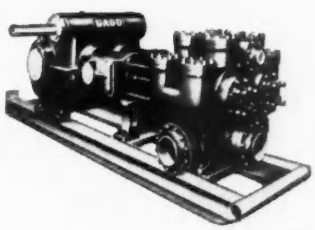
+ portability



+ salvagability



+ dependability



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Simple Arithmetic

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GASO PUMPS

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Freedom begins at home

IN America we take Freedom for granted. It is hard for us to understand why anybody would willingly give up his freedom, to live under a rule that dictates every move of his life.

Yet we must face the sobering fact that right here at home there are plenty of people who are working to curtail, and eventually to abolish personal freedom, and substitute rigid central controls over our activities. Too often these misguided groups and individuals work harder at their self-appointed tasks than do we who think we prefer freedom.

We as business men, above all others, perhaps, have a responsibility in this matter which we can ignore only at the peril of our own survival.

The Youngstown Sheet and Tube Company

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MANUFACTURERS OF CARBON, ALLOY AND YOLOY STEELS

ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

WORLD OIL

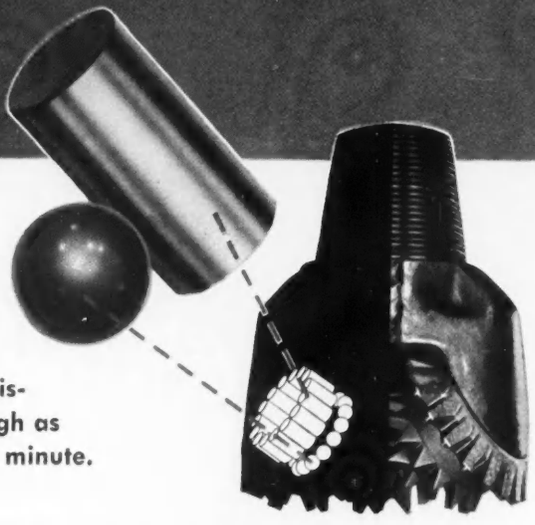
INTERNATIONAL SECTION

"WHEN YOU USE HUGHES PRODUCTS YOU GET PERFORMANCE WITH A BIG PLUS"

"Recently one of the Hughes men worked out a 'planned bit program,' on three wells, for me . . spotting bits in certain formations. I was amazed at the result. In each instance there was a marked decrease in lapsed drilling days and bits per well. That's what I call service beyond the call of duty and it surely fits right in with that old Hughes slogan, an 'Engineered Solution' for every drilling problem."

HUGHES TOOL COMPANY
HOUSTON, TEXAS
Standard of the Industry

HUGHES ROCK BITS
are built to "take it"

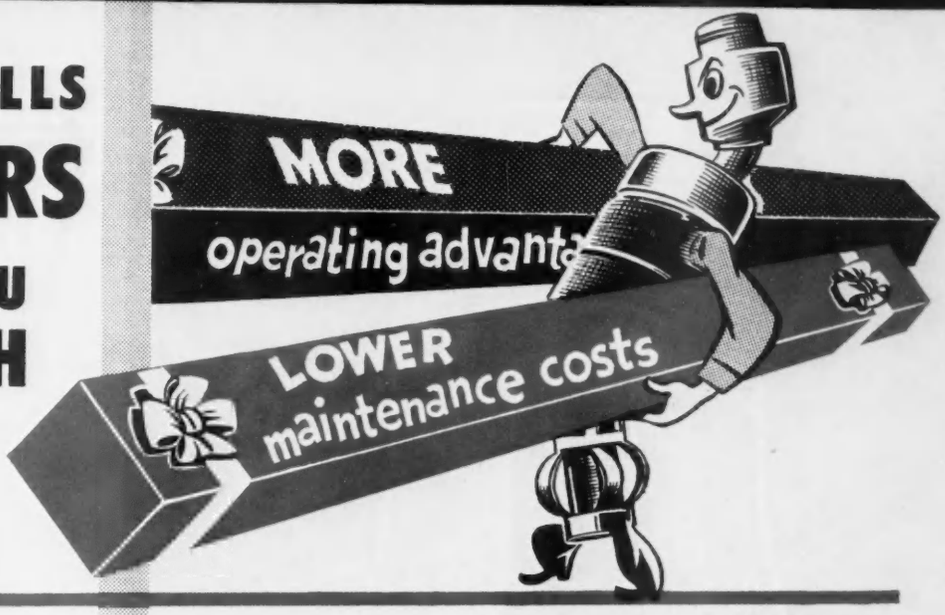


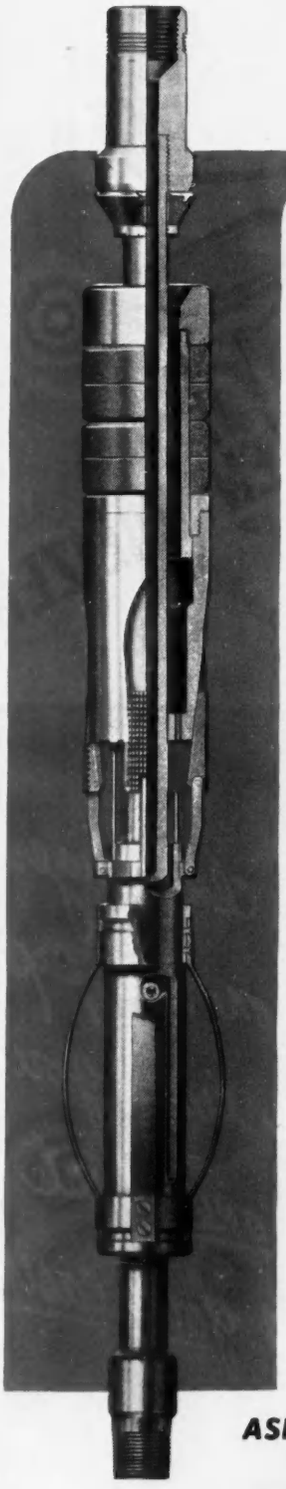
The ability of Hughes Rock Bits to "take it," under the most strenuous drilling conditions, is due partially to the fact that Hughes Rock Bits are provided with the strongest possible bearings and bearing surfaces. The Hughes bearing structure has been designed to stand up under extremely heavy duty. Satisfactory bearing life has been obtained with weights as high as 40,000 lbs. and rotary speeds of 40 to 50 revolutions per minute.

HUGHES TOOL COMPANY
HOUSTON, TEXAS

Standard of the Industry

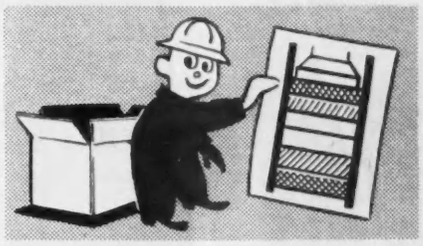
LANE-WELLS PACKERS GIVE YOU BOTH





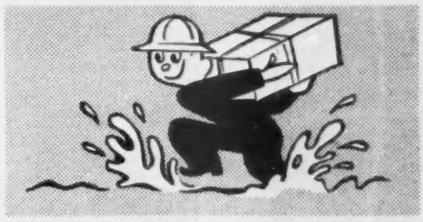
POSITIVE PACK-OFF

Outer rings of FLOSEAL Packing Ring Assembly control and confine "flow" of inner rings.



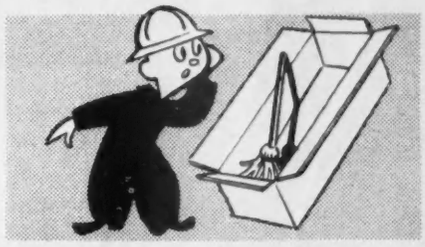
EASIER RUNNING

in fluid and increased circulation with generous by-pass area.



MINIMUM SWABBING ACTION

because FLOSEAL Packing Rings spring back to shape when released

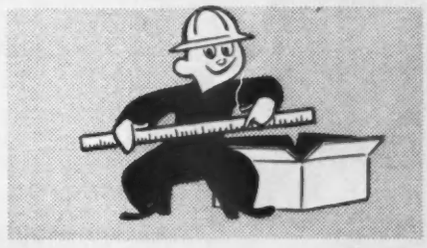


EXTRA-LARGE DOVETAILED SLIPS

ride in tapered grooves – can't get out to catch or drag. Crosscut wickers hold on hardest casing without shaving.

INSIDE DIAMETER SAME AS TUBING

to allow free passage of maximum size pumps, swabs, wire line instruments and other devices.



ASK THE LANE-WELLS MAN HOW THESE BETTER PACKERS HELP YOU PRODUCE MORE OIL AT LOWER COSTS!

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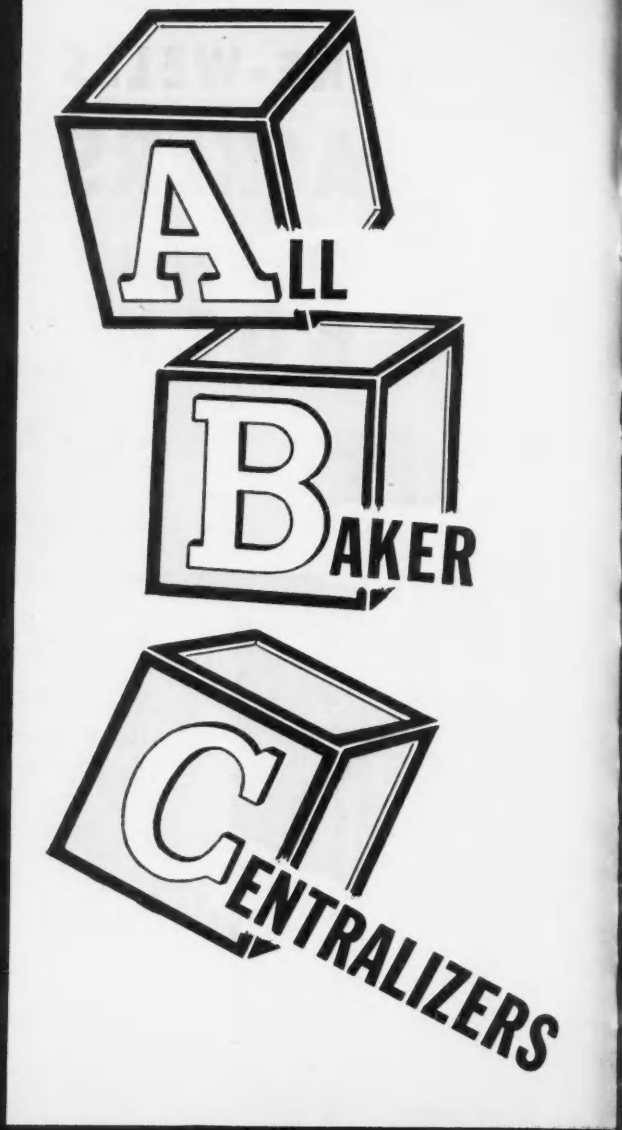

Almost any centralizer looks good on the pipe rack, but be sure you choose the one that always centers your casing.

BAKER MODEL "G"
CASING CENTRALIZER
PRODUCT NO. 910-G

SPRING POLE DRILLING RIG ▾ ▾ ▾ Early American brine wells and many of the first oil wells were drilled by the crude method illustrated above. With their feet in the stirrups, drillers "kicked down" scores of wells in the Oil Creek area of Pennsylvania. Baroid takes great pride in its part in developing new materials and methods for drilling oil wells.

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National Lead Company
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Air Conditioner

NOW, give your offices the invigorating comfort of cool, healthful filtered air with the new Philco single-room Air Conditioner. At a cost which soon pays for itself in greatly increased personnel efficiency, you can air condition any room . . . even in the most sweltering climates. The Philco Air Conditioner cools and dehumidifies the air, circulates it without draughts, filters out dust and pollen, and, pumps out stale air and smoke *anytime*, independent of cooling. Windows can be kept closed . . . shutting out noise, dust, dirt and heat. Inexpensive to install, operate.

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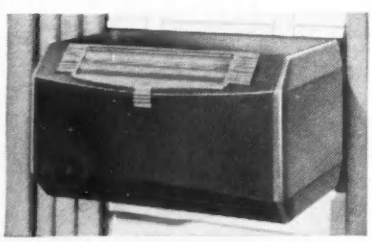
This worldwide organization of field engineers is available on contract to install Philco Air Conditioners in any location . . . and train your personnel in the simple procedure of proper maintenance. Write today for complete information . . . pave the way for greater comfort, greater efficiency, a high level of productive work no matter how hot it gets.

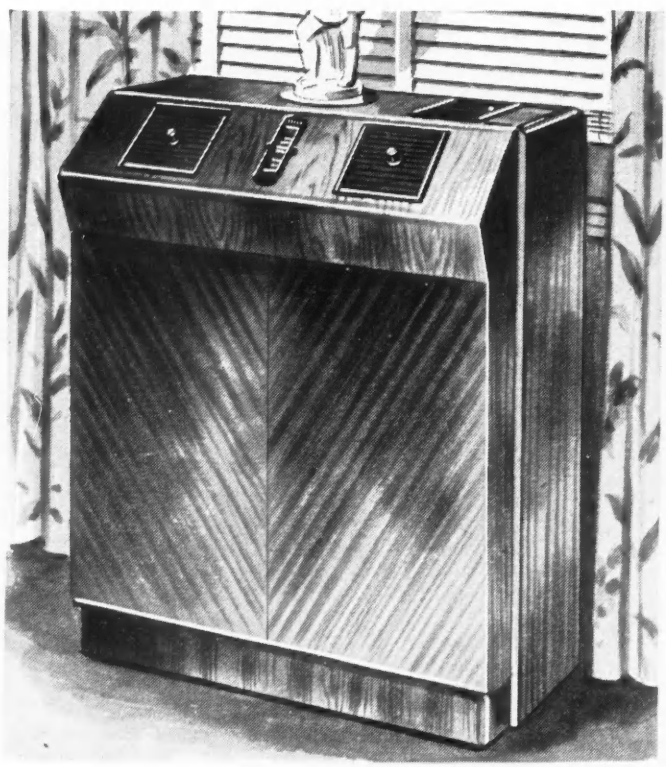


PHILCO WINDOW-SILL AIR CONDITIONERS

MODEL 76-E (*above*). Maximum cooling capacity in minimum space. Up to 7750 B.T.U. per hour. Provides fresh, filtered air all year. Hermetically sealed ¾ H.P. motor-compressor. Compact two-tone brown cabinet.

MODEL 61-D (*not shown*). New 1949 window sill model in two-tone brown cabinet. Cooling capacity up to 5600 B.T.U. per hour. Sealed ½ H.P. unit.

For information, write:
PHILCO INTERNATIONAL CORPORATION
50 BROADWAY, NEW YORK 4, NEW YORK



PHILCO CONSOLE AIR CONDITIONER 91-C. In handsome furniture-styled walnut. Up to 9000 B.T.U. per hour cooling capacity . . . ample power to serve offices up to 500 sq. ft. Powerful ¾ H.P. motor-compressor.

MODEL 101-C. Water cooled for use in rooms without access to outside air. Up to 9200 B.T.U. per hour cooling capacity. ¾ H.P. motor compressor. Console cabinet in richly figured walnut, same as illustrated above.

PHILCO

Famous for Quality the World Over

Baash-Ross News

BAASH-ROSS TOOL COMPANY • LOS ANGELES • HOUSTON • OKLAHOMA CITY • NEW YORK

OUR 29th YEAR

NOW—

Pipe strings specially designed for today's deep-well cutting, clean out and other small-pipe operations . . .

FLASH WELDED JOINTS

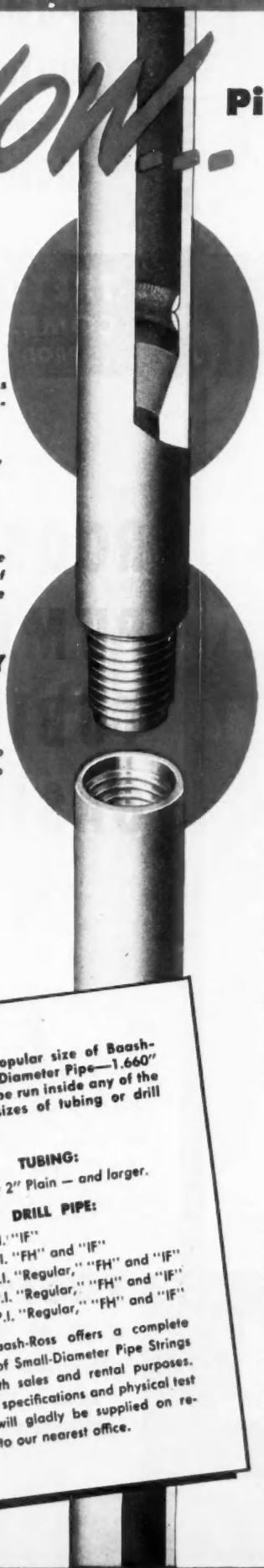
eliminate weaknesses of ordinary joint-to-pipe connections!

UNUSUALLY HIGH STRENGTH

as much as 3 times the tensile and torque of other strings with the same diameter!

EXTERNALLY FLUSH DIAMETER

Insures free passage through other pipe without hanging up!



Baash-Ross *High Strength* Small-Diameter PIPE STRINGS!

To match the deep well performance of Baash-Ross Cutting and Fishing Tools and Baash-Ross Power Swivels, Baash-Ross can now supply you with a new type of small-diameter pipe strings which feature unusually high strength factors—*both in tensile and torque!*

THE HIGH OVERALL STRENGTH IS ACHIEVED THROUGH THESE IMPORTANT FACTORS . . .

1 HIGH STRENGTH PIPE:
The pipe itself is made from chrome-molybdenum alloy steel tubing that is cold-drawn and normalized to provide very high strength-to-weight ratios in the pipe sections themselves.

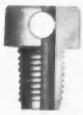
2 HEAT-TREATED TOOL JOINTS:
The tool joints are also made from alloy steel that is specially heat-treated to combine wear-resisting hardness with shock-resisting toughness and strength. The tool joints are internally upset to provide ample metal for the threads, and the thread pattern has been carefully engineered to combine high strength with easy make-up.

3 FLASH WELDED CONSTRUCTION:
The final step to insure all-around high strength is the unique method by which the pipe is joined to the tool joints. A specially-developed flash-weld process is used that not only joins the tool joints *directly* to the pipe (eliminating any threads or other weak points between pipe and joints) *but provides a weld section that is actually stronger than the pipe itself!*

RESULT—a small diameter, light weight pipe string with unusually high strength properties . . . minimum tensile, 100,000 lbs./sq. in.—minimum torque, 47,500 lbs./sq. in!

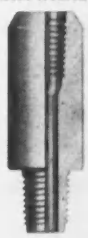
Completely Flush Outside Diameter In addition to small diameter, low weight, and unusually high strength, Baash-Ross Small-Diameter Pipe Strings also feature a completely flush outside surface with no bulges or increased diameters to hang up or cause difficulties when working inside of other pipe strings. Note that there are no external beads or projections of any kind at the welded joint—and the tool joints are of the same outside diameter as the pipe—thus assuring an absolutely flush surface at all points.

Accessory Equipment To insure maximum adaptability and convenience in using Baash-Ross Small-Diameter Pipe Strings, the following accessory equipment is also available . . .



ELEVATOR PLUGS
These plugs are inserted into the top joint of the Small-Diameter Pipe String to provide a convenient elevator shoulder for supporting the string and handling the flush pipe sections. Made of heat-treated and hardened alloy steel, these Plugs are available with male thread only.

STABILIZER SUBS
Operators use these between the joints of Small-Diameter Pipe Strings to provide stabilizing shoulders that reduce friction on long cutting strings when working inside of internal flush pipe. (When working inside internal upset pipe, the upsets themselves provide stabilization and no stabilizing Subs are used.) These Subs are made of heat-treated and hardened alloy steel—and are sufficiently larger in diameter than the pipe to provide an elevator shoulder for supporting and handling the string. They are removed only when the pipe is used inside of other strings where clearance restricts the use of Stabilizer Subs.



Wide Adaptability Baash-Ross Small-Diameter Pipe Strings are unusually adaptable to virtually any small-pipe operation—for operating cutting strings, rotating small bits, clean-out tools, etc. . . . and they are the ideal pipe string to use with the popular Baash-Ross Power Swivel, which more and more operators are adapting to a wide variety of light rotating operations.

The Strings are externally flush, so can be run with complete safety inside all types of pipe—even internal upset pipe. They are available in a full range of sizes, but the most popular size is 1.660" in outside diameter. This size has the greatest range of adaptability since it can be run inside of any of the sizes of tubing or drill pipe indicated in the panel at left. ***Write for full details!***

The most popular size of Baash-Ross Small-Diameter Pipe—1.660" O.D.—can be run inside any of the following sizes of tubing or drill pipe . . .

TUBING:

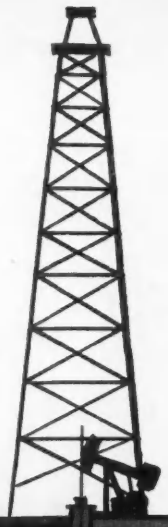
2" E. U. or 2" Plain — and larger.

DRILL PIPE:

2⅜" A.P.I. "IF"
3½" A.P.I. "FH" and "IF"
4½" A.P.I. "Regular," "FH" and "IF"
5½" A.P.I. "Regular," "FH" and "IF"
6⅝" A.P.I. "Regular," "FH" and "IF"

Baash-Ross offers a complete range of Small-Diameter Pipe Strings for both sales and rental purposes. Prices, specifications and physical test data will gladly be supplied on request to our nearest office.

KONTOL



PROTECTS SUB-SURFACE PUMPING EQUIPMENT *against* CORROSION

CORROSION PREVENTIVE

A TRETOLITE COMPANY PRODUCT

INSURES LONGER USEFUL LIFE

RODS
PUMPS
TUBING
CASING

KONTOL forms a strongly adsorbed film on metallic sub-surface equipment, preventing contact by corrosive elements. It has been tested and proved effective in gas, gas-condensate, sweet and sour crude wells. It is easy to apply by chemical pump injection or batch-dumping down the well annulus.

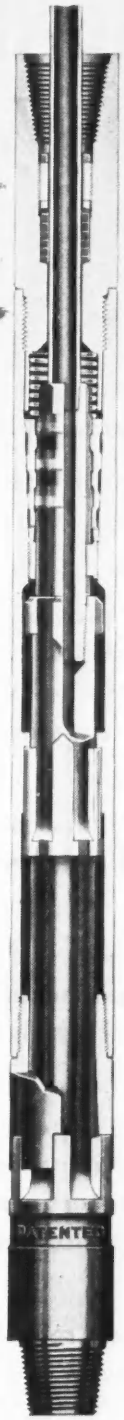
For complete details on KONTOL, and information on the KONTOL corrosion rate test service, write or call

KONTOL

TRETOLITE COMPANY
Manufacturing Chemists
St. Louis 19, Missouri
Los Angeles 22, California

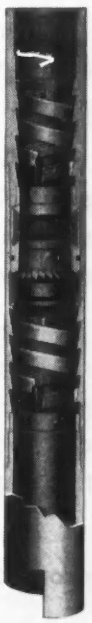
KG-49-1

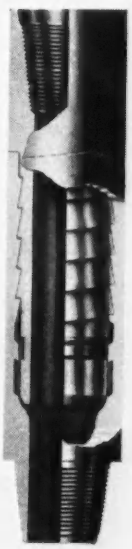
HOW TO INSURE AGAINST *Fishing failures* ON OVERSEAS DRILLING JOBS



TRANSPORTATION tie-ups . . . equipment shortages . . . inexperienced crews—these are a few of the risks you face today on overseas drilling projects. *And they're risks that make drilling safeguards even more essential to your operations than ever before!*

So make it a point to include Bowen Fishing Tools in your drilling equipment. With these safeguards on your rig, you're ready for nearly *any* emergency—a twist-off, stuck pipe, or any of a dozen other fishing jobs that hold back a drilling well. You can save thousands of dollars in transportation and equipment expenditures with positive, safe, rugged Bowen Tools on hand for any fishing job.





THE BOWEN FISHING JAR—operates without risky twisting or turning of the string . . . is fully adjustable for intensity of blow while in the hole . . . is fast in operation . . . and built for the hardest jarring jobs.

FULL CIRCLE TYPE SPEARS—New simplified design: Provides greater gripping surface . . . Prevents distortion of fish . . . Permits quicker change of slips . . . Increases safety . . . Gives greater versatility.

THE BOWEN OVERSHOT—catches drill pipe, coupling or tool joint without making any adjustments . . . utilizes exclusive spiral grapples that cinch tighter as pull increases . . . is easily released at any time.

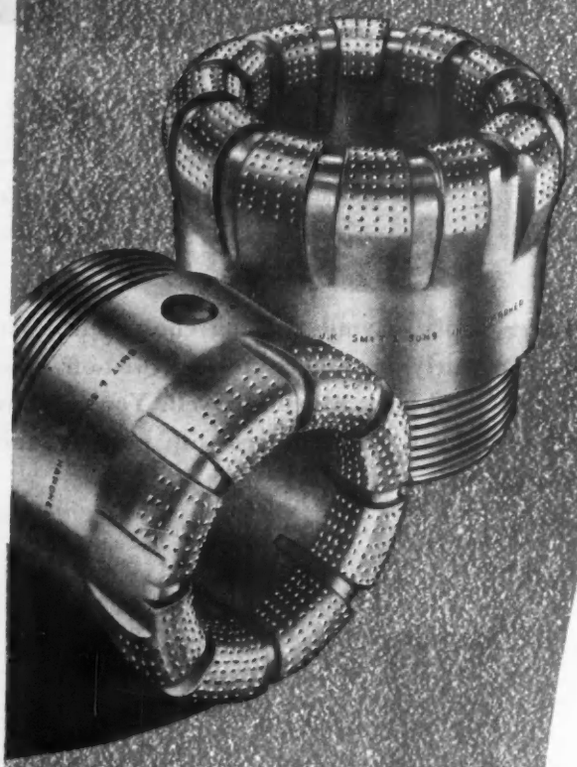
THE BOWEN SAFETY JOINT—a readily releasable connection for either drilling *or* fishing . . . delivers *full torque capacity* of string in *either* direction . . . has only four simple parts—box and pin sections and packers.

All **these Bowen Tools are available in sizes and combinations for your particular drilling strings. Get full details by writing—today—for your copy of the Bowen Catalog illustrating, describing and giving specifications on the complete Bowen line of fishing tools.**

SR BOWEN CO

MAIN OFFICE AND PLANT:
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL. R. WITTICH, JR.

Now... HARDHED DIAMOND DRILL BITS *in the Oil Fields...*



Established in 1888, J. K. Smit & Sons are among the pioneers in the manufacture of diamond bits.

The patented HARDHED Diamond Drill Bits, for many years the standard of the mining industry, are now available for oil well drilling.

Exceptional performance has been proven during the past two years in the Texas oil fields and they are now offered for coring all formations with the assurance that they will give entire satisfaction in every respect.

Carefully selected diamonds are set in a tough alloy matrix, which effectively resists the most abrasive drilling fluids.

HARDHED Drill Bits reflect new design and improved manufacturing methods, all aimed at increasing the high level of reliability for which JKS diamond products are noted.

We are now prepared to place the experience so gained, at the disposal of oil well drilling opertors through our distributors. JKS engineers are on call to assist them in the effective application of this improved drilling technique.

Core barrels avilable for sale or rent. For prompt service contact nearest distributor.

1888 SUPER MATERIAM IGNIS TRIUMPHANS 1949

61 Years of Progress

J. K. SMIT & SONS, INC.

157 CHAMBERS ST., NEW YORK 7, N. Y.

Factory: Murray Hill, N. J.

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DENVER 1, COL.

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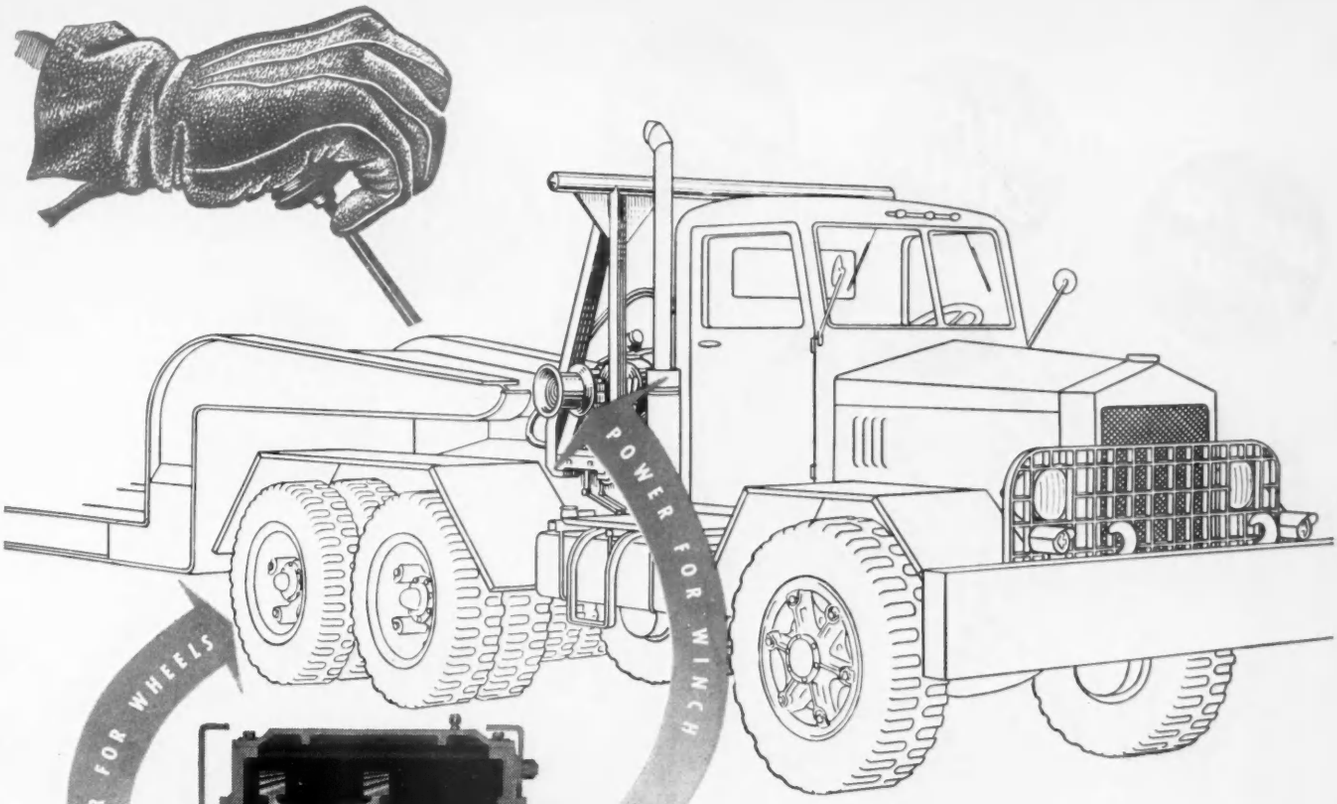
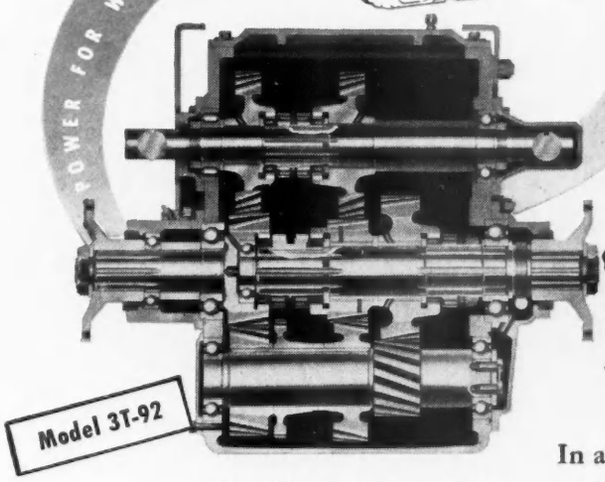
815 Midland Tower
MIDLAND, TEXAS

EASTMAN OIL WELL SERVICE CO., LTD.
47 Canada Life Bldg., CALGARY, ALTA., CAN.
104th St. & 71st Ave., EDMONTON, ALTA., CAN.





Single Unit *Double* Function

In a single, compact unit, Fuller's Model 3T92 Auxiliary Transmission combines a full-torque power take-off with a three-speed heavy-duty auxiliary transmission.

Power can be taken off either end of the power take-off drive shaft . . . giving extra flexibility to trucks engaged in rigging or other jobs involving winch work. Design of the power take-off as an integral part of the transmission case eliminates the inherent disadvantages of a separate, top-mounted power take-off . . . gives extra strength and rigidity.

Model 3T92 is only one of the extensive line of geared-to-the-job and proved-in-the-field Fuller transmissions that assure efficient truck performance.

FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION
KALAMAZOO 13F, MICHIGAN

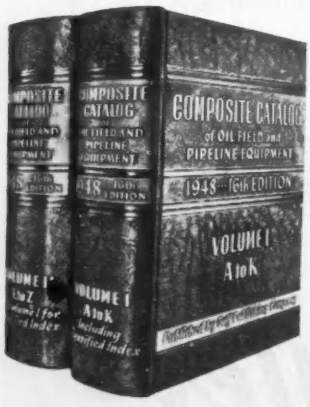
Unit Drop Forge Division, Milwaukee 1, Wisconsin
Western District Office (Both Divisions): 308 Thayer Building, 577 14th Street, Oakland 12, California

Fuller TRANSMISSIONS

Are these buying headaches costing you WAITING TIME?

SAY goodbye to troubles you've had keeping track of individual catalogs. None of these headaches will put "waiting time" on your buying operations when you use the Composite Catalog of Oil Field and Pipe Line Equipment to specify and order.

Thanks to the 462 equipment makers who have their complete or condensed catalogs filed in the current 4016-page Edition, Composite Catalog gives you the buying information you want, *where* you want it . . . *when* you're ready to buy. Inside the covers you'll find complete data on 2980 types of equipment, supplies and services used in exploration, drilling, production and pipe line work, indexed for easy reference by product and company.



From the "talking" stage to the "ordering" stage, use the Composite Catalog. It will make your buying job easier.

USE THIS UNIVERSAL EQUIPMENT CODE

COMPOSITE CATALOG

Published by WORLD OIL

Magcobar

Complete

DRILLING MUD SERVICE

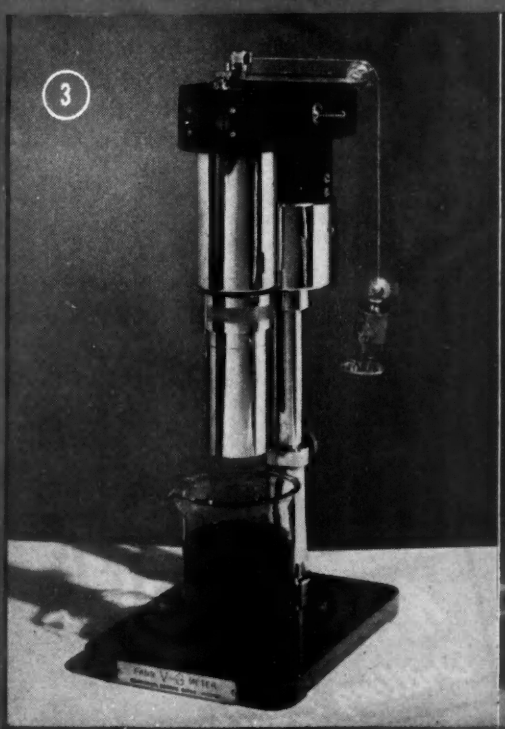
1. **RED MUD KIT** . . . contains complete set of chemicals for pilot testing red-lime muds.
2. **SALT AND ALKALINITY KIT** . . . for determination of alkalinity and chloride content of drilling muds.
3. **FANN V-G METER** . . . rugged 6-volt motor driven field model viscosimeter for obtaining viscosity and gel strengths quickly and accurately.
4. **FANN FILTER PRESS** . . . an accurate, portable, economical instrument for determining water loss and filter cake characteristics of drilling mud.
5. **FANN V-G METER** . . . dual speed, 115 volt, laboratory model.

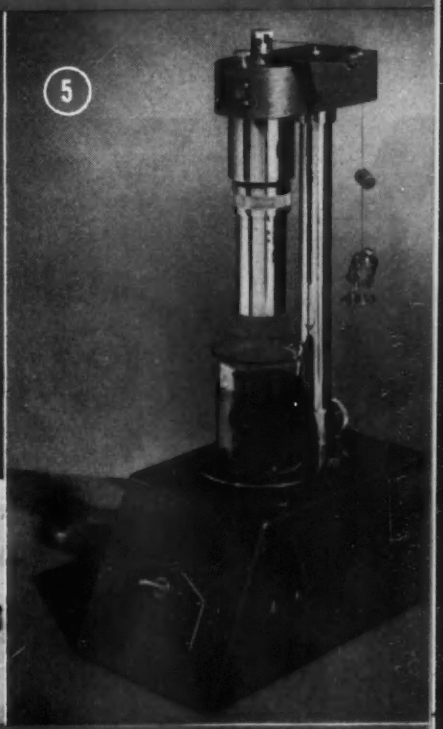
. . . INCLUDES FIELD AND LABORATORY

MUD TESTING EQUIPMENT

MAGNET COVE BARIUM CORPORATION, Malvern, Arkansas; Houston, Texas

Export: GUY E. DANIELS, 30 ROCKEFELLER PLAZA, NEW YORK, N. Y.





NOW...

BREWSTER'S SERVICE DEPARTMENT

. . . is available—day or night—to repair BREWSTER rigs anywhere in the United States, or ANY rig located in the Mid-Continent Area.

TEAR OUT the Card below and KEEP IT HANDY!

Completely equipped and manned by trained, experienced personnel, the Brewster Service Department is devoted exclusively to field service and repair of Brewster rigs *anywhere* in the U. S., or any make drilling rig in the Mid-Continent Area. When breakdowns or accidents shut down your operations, call the Brewster Service Department for replacement parts and fast, expert repair service. Night or day, a Brewster Service Man will be on his way to your drilling location by truck—or by air if necessary! A folder is available describing the facilities of the new Brewster Service Department—write for your copy today.

For **BREWSTER SERVICE**

CALL SHREVEPORT, LOUISIANA

DAY PHONE: **4-3255**

NIGHT PHONE: **7-3461**

ALTERNATE PHONE: 7-1902

The BREWSTER COMPANY, Inc.

SHREVEPORT, LOUISIANA

BREWSTER MATCHED Drilling Equipment

10 GOOD REASONS WHY OPERATORS PREFER

McCullough
GUN PERFORATOR SERVICE

1. **MEETS EVERY CONDITION.** Guns fired either electrically or mechanically: guns run on cable, sand line, drill pipe, tubing, or on piano-wire measuring line in extremely high-pressure wells.
2. **SIMULTANEOUS FIRING** under all conditions gives exact spacing of shots, perfect perforation pattern, and saves down-the-hole time.
3. **ACCURATE DEPTH MEASUREMENTS** put the shots right where you order them.
4. **MAXIMUM PENETRATION** of bullets into the formation, as proved repeatedly in competitive field tests.
5. **GUNS TO FIT EVERY CONDITION.** McCullough employs more than 30 different types and sizes of guns.
6. **ALL SIZES OF BULLETS** from $\frac{1}{16}$" dia. up to $\frac{3}{4}$" dia., to fit every possible need.
7. **BURRLESS BULLETS,** giving a completely burr-free hole, eliminating casing scraping, with *no* sacrifice of penetration.
8. **NO LOST TIME.** McCullough's simpler, lighter equipment cuts setting-up and moving-out time, speeds up every job.
9. **EXPERIENCED MEN.** With years of experience behind them, thoroughly-trained McCullough gun-perforating crews do their jobs quickly, efficiently, safely.

These Are Some of the Reasons Behind the Proven Fact That

McCullough

PUTS THE SHOTS WHERE THEY COUNT!

10 This is a section of a McCullough **90-SHOT GUN** perforating a 15-foot section with 6 holes to the foot, at one run.

McCullough TOOL COMPANY

5820 South Alameda St., Los Angeles 11, California
405 McCarty Avenue, (P. O. Box 2575) Houston, Texas

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WYOMING: Casper

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

Flashes from the BEACON

"Solving Natural Gas' Big Problem" . . . that's the title of a three-part article currently running in the BS&B BEACON. The problem of hydrates and new equipment to prevent their formation is stated in detail by staff writer Chauncey H. Black.

* * *

OIL TOWNS of the U. S. and Canada will have their day in an on-the-spot series . . . Oklahoma City, Denver, Houston, Dallas, and many more are part of the 1949 oil town parade in the BS&B BEACON.

* * *

After Dad gets the latest dope on oil field installations and new products, Mom will want to read "Paging the Ladies," a monthly feature by Woman's Editor Alberta Wilson Constant . . . The youngsters have their section, too, bright with pictures and puzzles.

* * *

WHAT'S HAPPENING to the cost of living . . . and why? BEACON Financial writer Elwyn L. Cady discusses the ups and downs of prices, production, and demand in clear, factual terms.

* * *

Engineers tell us the oil field trend is from vertical to horizontal . . . "Keep it low" is the watchword for equipment. The new BS&B Horizontal Separator will be introduced in an early issue of the BEACON.

* * *

One of the most widely-praised company magazines, the BS&B BEACON is mailed regularly, without charge, to those who enjoy it.

* * *

A request on your company letterhead will start the BS&B BEACON coming to you.

Write to:

BLACK, SIVALLS & BRYSON, INC.
Industrial and Public Relations Division
720 Delaware
Kansas City, Missouri

SQUEAKS from the BULLWHEEL

Daring Venture

"I've made a lot of money exposing girls like you."

"Blackmailer!"

"No, honey; I manufacture swim suits."

Winner by a Nose

"Why did you go to Dr. Frost?"

"Well, Dr. Smith has 10 to 1 on his door and Dr. Frost has 3 to 5. So I took the favorite."

Gripping Story

Hotel Manager: "Did you find any of our towels in that man's suitcase?"

Hotel Detective: "No, but I found a chambermaid in his grip."

Discretion Helps

A committee was appointed by a magazine to study the question of how best to hold a wife, and a selected list of husbands was written to. The only reply received was from a certain place of detention. It stated briefly: "I found the best way was around the neck, but it should not be overdone. Please note change of address."

We Can't Win

"Mama, if I get married will I have a husband like Daddy?"

"Yes, dear."

"And if I don't get married will I be an old maid like Aunt Minnie?"

"Yes, dear."

"Mama, it's a tough world for us women, isn't it?"

"Henry says it's the extra service he gives that makes steady customers."

Just a Drop in the Bucket

"Miss Helen," said the parson impressively, as he led her into the brook for baptism, "I'se gwine lead you out inter dis heah stream, an' wash out ev'y spot er sin you'se got."

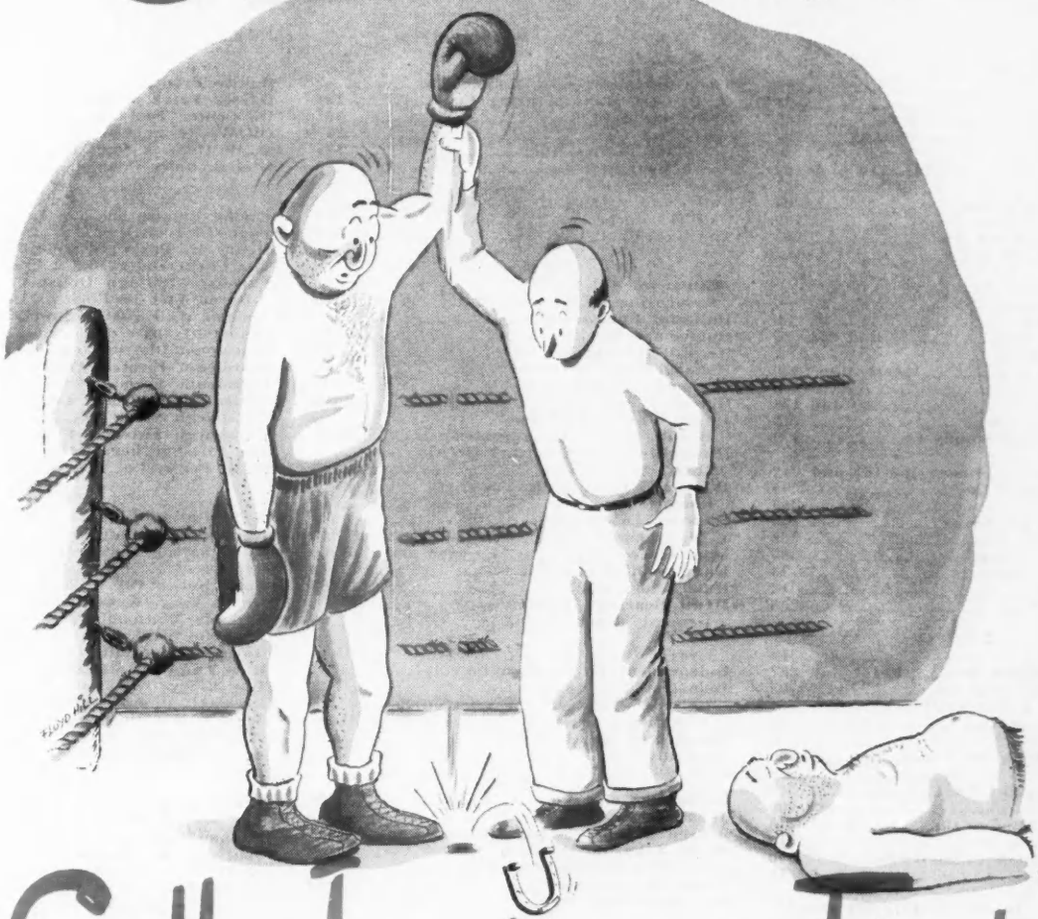
"Lawsy, Pahson," giggled the erstwhile frolicsome damsel, "in that li'l ol' shallow creek?"

Right to the Point

Coue complained that his famous formula, "Every day in every way, I'm getting better and better," was of little use in America. It took too long to say. Americans just cut it down to "Hell, I'm well."

...YOU'VE ALWAYS SAID HOW WONDERFUL LANE-WELLS PACKERS ARE ON TOUGH JOBS, SO NOW WHEN I ASK YOU TO GET ME ONE TO HELP WITH THE TRUNKS, YOU SAY LANE-WELLS PACKERS ARE ONLY FOR OIL WELLS — I NEVER HEARD ANYTHING SO RIDICULOUS... HOW COULD ANYONE PACK UP AN OIL WELL?-BLAH, BLAH, ETC.
HUBENTHAL

Steel Problems?



Call Jorgensen First

This fellow got off the BEAM when he thought he knew all the ANGLES. But now he's FLAT, COLD FINISHED. He didn't last one ROUND. Don't let a steel problem knock *you* out. Get Jorgensen in your corner and you won't be caught with your guard down. Licking tough steel problems is a Jorgensen SPECIALTY.

CALL JORGENSEN FIRST!

EARLE M. JORGENSEN CO.
STEEL

HOUSTON	LOS ANGELES	OAKLAND	SAN FRANCISCO
5311 Clinton Dr.	10650 So. Alameda	1657 22nd St.	Ask Operator for
Charter 4-1761	LUcas 0281	Higate 4-2030	Enterprise 10942

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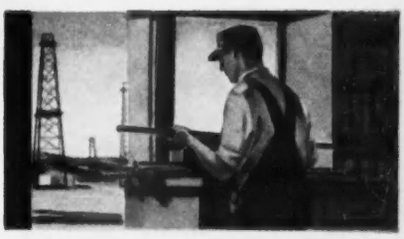

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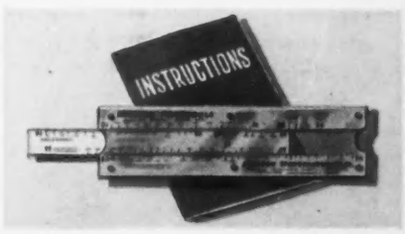

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